LSMP 5.6.1 Land Use

5.6.1.1 Potential Land Use Impacts

Rangeland and agricultural cropland are the primary land uses within the permit area and the surrounding area. A portion of the land within the permit area will be temporarily converted from its previous use as rangeland and cropland to ISR use on a progressive, phased basis during construction and operation of ISR well fields, processing facilities, and associated infrastructure. However, most of the permit area will be undisturbed, and surface operations (e.g., wells and processing facilities) will affect only a small portion of it. Section 5.3.7 describes

The land likely will experience an increase in human activity also contributing to land disturbance. The disturbance associated with drilling, pipeline installation, and facility construction will be limited and temporary as vegetation will be re-established through concurrent reclamation. The construction of access roads will be minimized to the extent possible by using and upgrading existing roads.

Operation of the project facilities will restrict the use of a portion of the land as rangeland and cropland for the duration of operations. This includes fenced well field areas, facility areas, and land application areas. This temporary change in land use will last until these areas are reclaimed and released for unrestricted use. Given the relatively small size of the impacted areas, the exclusion of grazing from well field and facility areas over the course of the project is expected to have minimal impact on local livestock production. Following reclamation, the permit area will be returned to the approved postmining land uses.

Recreational use, which is limited primarily to large game hunting, also will be temporarily impacted within the permit boundary. Hunting is currently open to the public on approximately 5,700 acres. Approximately 240 acres of federal land are managed by the BLM. SDGF&P leases around 3,000 acres annually of privately owned land and currently designates this acreage as walk-in hunting areas (refer to Section 3.1.2). Due to safety concerns, Powertech (USA) will work with BLM, SDGF&P and private landowners to limit hunting within the permit area to the extent practicable.

5.6.1.2 Mitigation of Potential Land Use Impacts

The following procedures will be used to minimize the potential impacts to land use.

• Disturbance will be limited to only what is necessary for operations; this will be done by using existing access roads as practicable and combining access road and utility corridors.

• Development of Quality Assurance/Quality Control (QA/QC) plan to monitor the effectiveness of mitigation methods.

• Restrict normal vehicular traffic to designated roads and keep required traffic in other areas of the well field to a minimum.

• Use Class V deep disposal wells to the extent practicable for disposal of liquid wastes to mitigate potential land use impacts from land application systems.

• Conduct site ISR reclamation in interim steps to minimize potential land use environmental impacts. Sequential well field development will minimize land area impacted at any one time.

• Ponds will be reclaimed and re-vegetated and the land released for postmining uses.

• After groundwater restoration is completed, each well field and associated pipelines and facilities will be decommissioned. This includes plugging and abandoning all wells in accordance with DENR requirements. As areas are restored, they will be backfilled, contoured, and smoothed to blend with the natural terrain in accordance with the surface reclamation plan.

• All processing facilities will be decontaminated and removed unless they are to be used for other future activities as agreed in writing by the surface owner.

• Prior to completion of reclamation, landowners will be contacted and given the option to retain the roads for their private use or have the roads reclaimed by Powertech (USA). If the roads are deemed beneficial to others (i.e., hunters, ranchers and residents) and the landowner agrees, the roads will not be reclaimed. Only roads related to ISR operations will be reclaimed.

SEIS 4.2 Land Use Impacts

As described in GEIS Section 4.4.1, potential environmental impacts to land use will occur during all phases of an ISR facility's lifecycle (NRC, 2009a). Impacts to land use will result from (i) land disturbances in conjunction with construction, operations, and decommissioning activities; (ii) access restrictions that will limit grazing and recreational activities; and (iii) competing access for mineral rights (e.g., leasing of land for both uranium and oil and gas exploration and development).

GEIS Construction Phase Summary

NRC staff concluded in the GEIS that land disturbances during the construction phase will be temporary and limited to small areas within permitted boundaries. After construction, disturbed areas around well sites, staging areas, and trenches will be immediately reseeded and restored. In GEIS Section 4.4.1.1, NRC staff also concluded that changes to land use due to grazing restrictions and limits on recreational activities are expected to be limited because restricted areas will be small, the restrictions will be temporary, and other land is available for these activities. Recognizing that the magnitude of land disturbances and access restrictions will vary significantly during construction, the NRC staff assessed the potential impacts on land use during construction in the Nebraska-South Dakota-Wyoming Milling Region as ranging from SMALL to LARGE. (NRC, 2009a)

GEIS Operations Phase Summary

Land use impacts from operational activities will be similar to impacts anticipated during the construction phase, because additional land disturbances and access restrictions are not expected while operational activities are ongoing. Because impacts from access restrictions and land disturbances will be similar to or less than construction impacts, NRC staff concluded in the GEIS that the overall potential impacts on land use from operational activities at an ISR facility will be SMALL. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

Because aquifer restoration will use the same infrastructure that is present during operation phases, land use impacts from aquifer restoration are expected to be similar to or less than operation impacts. As aquifer restoration proceeds and wellfields are closed, operational activities will diminish. Therefore, NRC staff concluded in the GEIS that aquifer restoration impacts to land use will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

NRC staff concluded in the GEIS that decommissioning an ISR facility will temporarily increase land-disturbing activities, such as, dismantling, removing, and disposing of materials equipment, and excavated contaminated soils. Access restrictions will remain in place until decommissioning and reclamation are complete, although a licensee may decommission and reclaim the site in stages. Reclamation of land to preexisting conditions and uses will help to mitigate potential long-term impacts. NRC staff concluded in the GEIS that impacts to land use during decommissioning may range from SMALL to MODERATE and will be SMALL after decommissioning and reclamation activities are complete. (NRC, 2009a)

The potential environmental impacts on land use from construction, operations, aquifer restoration, and decommissioning for the proposed Dewey-Burdock ISR Project are detailed in the following sections.

4.2.1 Proposed Action (Alternative 1)

As described in SEIS Section 3.2, the proposed Dewey-Burdock ISR Project site encompasses 4,282 ha [10,580 ac] (Powertech, 2009a). Approximately 97.5 percent of surface rights in the proposed project are held privately, and the U.S. Bureau of Land Management (BLM) holds the remaining 2.5 percent. Land will be converted temporarily from its primary use as rangeland to use as an ISR facility, with facilities constructed and wellfields brought into production over time. Subsurface mineral rights are divided among several private entities and BLM (Powertech, 2009b). The applicant leases both surface and subsurface mineral rights in portions of the proposed project area where it plans to extract uranium. The applicant controls the unpatented mineral claims associated with 1,708 ha [4,220 ac] of federal minerals the U.S. government reserved under the Stock-Raising Homestead Act. The applicant also maintains unpatented mining claims on the 97 ha [240 ac] of BLM-administered surface lands within the project area (see SEIS Section 3.2).

In the GEIS, NRC staff identified potential land use alterations to ecological, historical, and cultural resources that range from SMALL to LARGE. In this SEIS, NRC staff present potential ecological impacts from land use in SEIS Section 4.6 and potential historical and cultural impacts from land use in SEIS Section 4.9. Impacts to soils from surface disturbances are discussed in SEIS Section 4.4. NRC staff assessed potential impacts on mineral extraction, grazing, or recreational activities that may result from the land disturbances and associated access restrictions during the construction, operation, aquifer restoration, and decommissioning phases at the proposed facility.

The applicant described environmental impacts on land use for each of the liquid waste disposal options (which are discussed in following sections) include (i) disposal via Class V injection

land application.

4.2.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid waste is deep well disposal via Class V injection wells. The section discusses potential environmental impacts on land use from construction, operations, aquifer restoration, and decommissioning associated with the Class V injection well disposal option at the proposed Dewey-Burdock ISR Project.

4.2.1.1.1 Construction Impacts

Construction phase activities, including drilling, trenching, excavating, grading, and surface facility construction, will have the largest direct land use impact at the proposed Dewey-Burdock site. As described in SEIS Section 2.1.1.1.2, initial construction of processing facilities, infrastructure (e.g., pipelines, access roads, power lines, and storage ponds), and wellfields is expected to be completed within 2 years (see Figure 2.1-1), followed by phased construction of additional wellfields during the operational phase.

A breakdown of estimated land disturbance for the facilities and infrastructure associated with the Class V injection well disposal option is provided in Table 4.2-1. For this disposal option, a total of 98.3 ha [243 ac] of land or 2.3 percent of the proposed permit area will be potentially disturbed by activities associated with construction of site buildings, pipelines, wellfields, ponds, and access roads (Powertech, 2010a). The total amount of BLM-managed land expected to be disturbed during construction activities is 4.7 ha [11.63 ac]. Land disturbance on BLM-managed land includes an access road, overhead power lines, wellfields, and underground pipelines. The total land area projected to be disturbed by construction activities for the Class V injection well disposal option, 98.3 ha [243 ac], is relatively small compared to the 4,282-ha [10,580-ac] permitted area of the proposed project.

Table 4.2-1. Breakdown of Land Disturbance for the Class V Injection Well and Land Application Disposal Options at the Proposed Dewey-Burdock *In-Situ* Recovery Project

Facilities/Infrastructure	Surface Disturbance
Disposal Via Class V Injection Wells	
Site Buildings	9.7 ha [24 ac]
Trunkline Installation	10.1 ha [25 ac]
Access Roads	8.5 ha [21 ac]
Wellfields	56.7 ha [140 ac]
Impoundments (ponds)	13.4 ha [33 ac]
Total	98.3 ha [243 ac]
Disposal Via Land Application	
Site Buildings	9.7 ha [24 ac]
Trunkline Installation	10.1 ha [25 ac]
Access Roads	8.5 ha [21 ac]
Wellfields	56.7 ha [140 ac]
Impoundments (ponds)	55.0 ha [136 ac]
Irrigation Areas	425.7 ha [1,052 ac]
Total	565.7 ha [1,398 ac]
Source: Powertech (2010a)	

To mitigate impacts of surface disturbance during construction, the applicant proposes to reclaim the surface and reestablish vegetation in areas disturbed by drilling, pipeline installation, and facility construction as soon as construction activities are completed (Powertech, 2009a). In addition, the applicant proposes to minimize construction of new access and secondary roads by building only roads essential to operations. Vehicular traffic in the wellfields during construction will also be restricted to designated roads and kept to a minimum to reduce the area of surface disturbance (Powertech, 2009a).

The applicant will enclose the processing facilities, storage ponds, and wellfields to restrict and control access with fences (Powertech, 2009a). As discussed in SEIS Section 2.1.1.1.2.1, the Burdock central processing plant will be located on approximately 2.7 ha [6.7 ac] and surrounded by a controlled access area fence throughout the life of the project. The Dewey satellite facility will be located on 1.2 ha [2.9 ac] and will be surrounded by a controlled access area fence. Radium settling and storage ponds constructed for liquid waste management will be fenced throughout the life of the project to restrict access. As described in Section 2.1.1.1.2.4.1 of this SEIS, 2.7 ha [6.8 ac] of radium-settling and storage ponds in the Dewey area and 3.4 ha [8.3 ac] of radium-settling and storage ponds in the Burdock area will be fenced, if the Class V injection well disposal option is implemented. Fences surrounding the processing facilities and ponds will be inspected daily (Powertech, 2010a).

Fences restricting access to wellfields in the Dewey and Burdock areas will be temporary and will be removed after operations and reclamation of each wellfield are completed (Powertech, 2010a). To minimize the acreage fenced around the wellfields, fencing will enclose only the injection and production wells. Fencing will not surround the perimeter monitor wells

(Powertech, 2010a). The applicant will cover each perimeter monitor well with a locking device to limit access. Header houses are to be secured within wellfield fencing (Powertech, 2010a). The applicant will use fencing techniques that preserve habitat and allow the movement of large game (Powertech, 2010a).
Fencing will not be built around the Class V injection wells to be used for deep well liquid waste disposal (Powertech, 2010a). Class V injection well heads and pumping equipment will be located inside locked buildings to restrict access (Powertech, 2010a).
Recreational activities, including hunting and off-road vehicle access, will be limited by fences and restrictions on access to roads and wellfields. As described in SEIS Section 3.2.2, hunting is currently open to the public on 3,521 ha [8,700 ac] within the project area. Hunting within the project area will remain open to the public during the construction phase (Powertech, 2011). Only a small part of the 4,282-ha [10,580-ac] of project area will be enclosed by fencing; 3.9 total ha [9.6 total ac] of processing facilities and 6.6 total ha [15.1 total ac] of radium-settling and storage ponds will be enclosed throughout the life of the project. Fencing around wellfields will be temporary. The public will have access to open, unfenced lands for recreational activities within and surrounding the proposed project area.

The exploration of mineral resources other than uranium (e.g., oil and natural gas) will be intermixed within the permit area or delayed until operations, decommissioning, and restoration activities end. Pending or potential oil and gas mineral leases are not present in the project area. Demand is low for oil and gas leases on available land near the Dewey-Burdock site (see SEIS Section 3.2.3). In addition, no coal mines or coal bed methane production are located near the site.

Estimates of the amount of land disturbed by ISR facilities, presented in the GEIS, ranged from 49–753 ha [120–1,860 ac] (NRC, 2009a). The NRC staff concluded in the GEIS that the impact of disturbing this area will be SMALL. The land area projected to be disturbed by construction activities for the Class V injection well disposal option is 98.3 ha [243 ac] and is relatively small compared to the 4,282 ha [10,580 ac] of the proposed project area; this falls at the low end of land disturbance estimates in the GEIS. The applicant proposes to use the following concurrent mitigation measures to minimize the impacts of surface disturbance: reclaiming and re-vegetating disturbed areas, limiting construction of new access roads, and restricting vehicular traffic in wellfields.

Fenced areas around processing facilities and storage pond areas will be relatively small in comparison to the permitted area of the proposed project. Furthermore, fences around wellfields are temporary and will be removed after operational and reclamation phases are completed in the wellfields. Prohibiting grazing within fenced areas during construction will have only a SMALL impact on local livestock production. Because there will be abundant open land available around the proposed facilities and surrounding the proposed project area, impacts to recreational activities (primarily big game hunting) will be SMALL. Due to the low demand for oil and gas leasing and absence of coal bed methane production on land within and in the vicinity of the project area, the impact of competing access for mineral rights is expected to be SMALL. Therefore, the NRC staff conclude that overall land use impacts during the construction phase for the Class V injection well disposal option will be SMALL.

4.2.1.1.2 Operations Impacts
The primary changes to land use during the operations phase of the proposed Dewey-Burdock ISR Project will be land disturbance and access restrictions from the expansion of active wellfields and development of new wellfields. Land disturbance and access restrictions will result from drilling new wells and constructing additional header houses and pipelines.

Livestock grazing and recreational activities will be restricted from ISR surface facilities, surface impoundments, and wellfields during the operations phase. During the operational life of the project, fencing around wellfields will remove 56.7 ha [140 ac] of land from grazing and recreational uses (see Table 4.2-1). On BLM-managed land, fencing around wellfields B-WF1 through B-WF4 (see Figure 2.1.6) will remove 3.8 ha [9.4 ac] of land from grazing and recreational uses in the Burdock area over the operational life of the project. The applicant will restore and reclaim wellfields concurrently, as operations are completed and moved to the next wellfield (Powertech, 2009a). As uranium recovery activities cease at a wellfield, the area will be restored and reopened to grazing and recreational uses while a new wellfield is developed. The sequential movement of active operations from one wellfield to the next will minimize potential impacts on grazing and recreational uses throughout the operational life of the project.

If operations are licensed, the applicant has committed to working with BLM, South Dakota Game, Fish, and Parks (SDGFP) and private landowners to limit public access, primarily for hunting (Powertech, 2011). To limit hunting activities in areas of active ISR operations, temporary fencing, advisory signs, and gates will be installed near processing plants and wellfields. Hunting in areas of active ISR operations will also be limited by rules related to the SDGFP walk-in hunting program on private lands, which prohibit the discharge of a firearm continue over the operational life of the project.

In summary, impacts due to land disturbance during the operations phase of the proposed project will be limited to the wellfields and will be similar to impacts expected during the construction phase. Access restrictions during the operations phase will be similar to construction impacts. Processing facilities and storage ponds will remain fenced. The construction of temporary fencing around operational wellfields will restrict livestock grazing and hunting. Once operations are completed in a wellfield, the wellfield will be restored and reopened to grazing and recreational use. Substantial acreage within and surrounding the 4,282-ha [10,580-ac] project site will remain open to grazing and hunting. Therefore, NRC staff conclude that the overall impacts to land use from operations for the Class V injection well disposal option will be SMALL.

4.2.1.1.3 Aquifer Restoration Impacts

The aquifer restoration phase will use the same operational infrastructure and require the same level of infrastructure maintenance as the operations phase. Land use impacts from aquifer restoration will decrease as fewer wells and header houses are used. Additionally, equipment traffic and related impacts will diminish. NRC staff conclude that the potential impacts to land use during the aquifer restoration phase for the Class V injection well disposal option will be comparable to those of the operations phase and will be SMALL.

4.2.1.1.4 Decommissioning Impacts

Commented [SV1]: Although the decommissioning phase does not involved injection activity, this phase is an indirect effect of injection activity.

As described in SEIS Section 2.1.1.1.5, decommissioning of the proposed Dewey-Burdock ISR Project will be based on an NRC-approved decommissioning plan, and all decommissioning activities will be carried out in accordance with 10 CFR Part 40 and other applicable federal and state regulatory requirements. The applicant will submit a decommissioning plan for NRC review and approval at least 12 months before the planned commencement of final decommissioning (Powertech, 2009b). At the proposed Dewey-Burdock site, the impact from dismantling and decontaminating the central plant, satellite facility, roads, and support facilities will be consistent with NRC staff conclusions reached in the GEIS. The land potentially disturbed as part of the proposed action will be returned to its preoperational condition and will be available for its preoperational use for livestock grazing and wildlife habitat (Powertech, 2009a).

After surface operations are complete and wellfields are restored, the applicant will proceed with the final steps of decommissioning and surface reclamation, and it will return the land to its preoperational conditions (Powertech, 2009b). The areas directly impacted by decommissioning include the central processing plant, satellite facility, wellfields and their infrastructure (i.e., pipelines and header houses), Class V injection wells, ponds, and access roads. SEIS Section 2.1.1.1.5 describes the decommissioning activities that are necessary to return the site to its previous land use. These activities include conducting radiological surveys, removing contaminated equipment and materials, cleaning up areas, plugging and abandoning wells, decontaminating and removing buildings and other onsite structures, and restoring disturbed areas (Powertech, 2009b). As disturbed areas are restored, they will be backfilled, contoured, and smoothed to blend with the natural terrain in accordance with the NRC-approved decommissioning plan. All wells are to be sealed and capped, and wellfield pipelines removed. After well plugging and abandonment and wellfield decommissioning are complete, seeded soil terrain. As decommissioning and reclamation proceed, the amount of disturbed and fenced land will decrease and the structures that could alter the setting of the project area will be removed. The dismantling of the proposed project facilities, infrastructure, and roads, together with the reseeding and placement of soil will have impacts similar in scale to the construction phase.

At the end of decommissioning, all lands will be returned to their preoperational land use of livestock grazing and wildlife habitat, unless the state and the landowner justify or approve an alternative use (e.g., landowners will be given the option to retain roads or buildings constructed for the ISR project for private use) (Powertech, 2009a). Reclaimed lands will be released for other uses. Livestock grazing and recreational activities will no longer be restricted. The land use impacts for disturbed areas will be MODERATE until vegetation is reestablished in seeded areas. Once vegetation is reestablished in reclaimed areas, the NRC staff conclude the land use impacts for the Class V injection well disposal option will be SMALL.

4.2.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant will dispose of liquid waste generated by land application (see SEIS Section 2.1.1.1.2.4.2). The locations of land application areas for this disposal option are shown in Figure 2.1-12. The potential environmental impacts on land use from construction, operations, aquifer restoration, and decommissioning associated with the land application disposal option are discussed in the following sections.

Commented [SV2]: Although land application of ISR waste fluids does not involve injection activity, this activity is an indirect effect of Class III injection activity because it involves disposal of ISR waste fluids that would not have been generated if Class III injection activities had not occurred.

4.2.1.2.1 Construction Impacts

A breakdown of estimated land disturbance for the facilities and infrastructure associated with the land application option is provided in Table 4.2-1. A total of 565.7 ha [1,398 ac] of land, or 13.2 percent of the proposed permit area, will be disturbed by activities associated with construction of facilities, pipelines, wellfields, storage ponds, irrigation areas, and access roads (Powertech, 2010a). This area of land disturbance is larger than anticipated for the Class V injection well disposal option {approximately 98 ha [243 ac]} due to the addition of land irrigation areas {426 ha [1,052 ac]} and the need for increased pond capacity for storage during nonirrigation periods {35 ha [136 ac]} (see Table 4.2-1). The land application option will not impact the total amount of BLM-managed land expected to be disturbed during construction activities at the proposed project site {4.7 ha [11.63 ac]}. As described in SEIS Section 4.2.1.1.1, land disturbance on BLM-managed land includes an access road, overhead power lines, wellfields, and underground pipelines (see SEIS Section 4.2.1.1.1). The total land area projected to be disturbed by construction activities for the land application option {i.e., 565.7 ha [1,398 ac]} is relatively small in comparison to the 4,282-ha [10,580-ac] permitted area of the proposed project.

Mitigation measures, such as performing concurrent reclamation and revegetation of disturbed surface areas, limiting construction of new access and secondary roads, and restricting vehicular traffic in wellfields and land application areas, will reduce the impacts of surface disturbance associated with construction activities for the land application disposal option (Powertech, 2009a).

With the exception of radium settling and storage pond areas, fencing restrictions and their impacts on land use during the construction phase for the land application option will be similar to those of the Class V injection well disposal option. Fenced areas around radium settling and storage ponds to restrict access will increase to approximately 12.5 ha [30.8 ac] in the Dewey area and approximately 13.6 ha [33.5 ac] in the Burdock area (see SEIS Section 2.1.1.1.2.4.2). The increase in fenced areas around ponds for the land application disposal option will remain small in comparison to the 4,282-ha [10,580-ac] permitted area for the proposed project. The applicant does not plan to construct fencing around potential land irrigation areas during the construction phase of the project, and these areas will remain open to hunting (Powertech, 2010a).

As noted in SEIS Section 4.2.1.1.1, the degree of land disturbance at ISR facilities analyzed in the GEIS ranged from 49–753 ha [120–1,860 ac], and NRC staff concluded in the GEIS that impacts from this range of disturbed land area will be SMALL (NRC, 2009a). The land area to be disturbed by construction activities for the land application option {i.e., 565.7 ha [1,398 ac]} is relatively small when compared to the 4,282-ha [10,580-ac] permitted area of the proposed project. The amount of disturbance falls within the estimates evaluated in the GEIS. Impacts of surface land disturbance will be minimized by mitigation measures, including concurrently reclaiming and revegetating surface disturbed areas, limiting construction of new access roads, and restricting vehicular traffic in wellfields and land application areas. Processing facilities, pond areas, and wellfields will be fenced; however, only relatively small areas will be restricted, and fencing around wellfields will be temporary. Therefore, the restriction of livestock grazing within areas fenced off during construction will have a SMALL impact on local livestock production. Land irrigation areas will not be fenced during the construction phase of the project. In addition, open land will be available around the proposed facilities and within the proposed project area. Because of these factors, impacts to recreational activities (primarily big game hunting) will be SMALL. Therefore, the NRC staff conclude that overall land use impacts during the construction phase for the land application disposal option will be SMALL.

4.2.1.2.2 Operations Impacts

The primary change expected to affect land use during the operations phase of the proposed facility is the expansion of active wellfields and development of new wellfields, and the impact will be similar to that of the construction phase. Grazing and recreational activities will be restricted from processing facilities, storage ponds, and wellfields during the operations phase. The need for fencing around wellfields will remove approximately 56.7 ha [140 ac] of land from grazing and recreation activities over the operational life of the project; this is the same acreage as the Class V injection well disposal option requires (see Table 4.2-1). On BLM-managed land, fencing around wellfields B-WF1 through B-WF4 will remove 3.8 ha [9.4 ac] of land from grazing and recreational activities in the Burdock area over the operational life of the project. The applicant will restore and reclaim wellfields concurrently, as operations are completed and moved to the next wellfield (Powertech, 2009a). Therefore, a wellfield where uranium recovery activities have ceased will be restored and reopened for grazing at the same time a new wellfield is being developed. The sequential movement of active operations from one wellfield to the next shifts and minimizes potential impacts to livestock grazing and recreational land over the operational life of the project.

In addition to fencing processing facilities, ponds, and wellfields, the applicant may fence land application areas to control livestock access to these areas (Powertech, 2010a). As described in SEIS Section 2.1.1.1.2.4.2, the maximum estimated area for land application is 426 ha [1,052 ac], and this acreage includes operating irrigation pivots, standby irrigation pivots, and surface stormwater runoff catchment areas. The land application area is relatively small when compared to the 4,282-ha [10,580-ac] permitted area. Moreover, substantial open land within and surrounding the project site will be available for livestock grazing.

The applicant has committed to work with BLM, SDGFP, and private landowners to limit recreational activities (primarily hunting) within the project area to the extent practicable before operations begin (Powertech, 2011). Temporary fencing, signage, gates, and other means of restricting public access will be used in active ISR areas, such as wellfields and processing plants, and may be used in land application areas. The SDGFP walk-in hunting program on private lands, which prohibits the discharge of a firearm within 98.4 m [300 ft] of a person or a structure, will limit hunting where active ISR operations are ongoing (Powertech, 2011). Limits on hunting will be in effect over the operational life of the project.

Impacts due to land disturbance during the operations phase will be restricted to the wellfields and are expected to be similar to impacts from construction. Access restrictions during the operations phase will be similar to those of the construction phase, except for land irrigation areas. Processing facilities and storage ponds will remain fenced to restrict and control human and wildlife access. Temporary fencing will be constructed around operational wellfields to restrict grazing and hunting. A maximum of 426 ha [1,052 ac] of land irrigation area may be fenced to control livestock grazing and limit access by hunters. The acreage of land application area is relatively small in comparison to the permitted area. In addition, substantial open area within and surrounding the 4,282-ha [10,580-ac] project site will remain open to grazing and hunting. Therefore, NRC staff conclude that the overall impacts to land use from operations for the land application disposal option will be SMALL.

4.2.1.2.3 Aquifer Restoration Impacts

The surface disturbance and access restrictions anticipated in the construction and operational phases will continue during aquifer restoration if the land application disposal option is implemented. Land use impacts from aquifer restoration will decrease over time, as fewer wells and pump houses are used and overall equipment traffic diminishes. Thus, NRC staff conclude that the overall potential impacts to land use during the aquifer restoration phase for the land application disposal option will be comparable to those of the operations phase and will be SMALL.

4.2.1.2.4 Decommissioning Impacts

Decommissioning areas after the land application disposal option will bring about environmental impacts similar to those described in SEIS Section 4.2.1.1.4 for the Class V injection well disposal option. Decommissioning the proposed facility will require an NRC-approved decommissioning plan. All decommissioning activities will be carried out in accordance with 10 CFR Part 40 and other applicable federal and state regulatory requirements.

After surface operations are complete and wellfields are restored at the proposed facility, the applicant will proceed with the final steps of decommissioning and surface reclamation to return the land to its preoperational conditions (Powertech, 2009b). The areas directly affected by decommissioning will include the central processing plant, satellite facility, wellfields and related pipelines and header houses, irrigation areas, ponds, and access roads. SEIS Section 2.1.1.1.5 describes the decommissioning activities required to return the site to its previous land use.

These activities are summarized in SEIS Section 4.2.1.1.4 and include conducting radiological surveys, removing contaminated equipment and materials, cleaning up areas, plugging and abandoning wells, decontaminating and removing buildings and other onsite structures, and restoring disturbed areas (Powertech, 2009b). Land application areas will be included in decommissioning surveys to ensure soil concentration limits are not exceeded. As decommissioning and reclamation proceed, the amount of disturbed and fenced land will decrease and structures that affect the setting of the project area will be removed. The dismantling of the proposed project facilities, infrastructure, and roads and reseeding and placement of soil will have impacts similar in scale to the construction phase.

At the end of decommissioning, all lands will be returned to their preoperational uses of livestock grazing and wildlife habitat, unless the state and the landowner justify or approve an alternative use. For example, landowners will be given the option to retain roads or buildings constructed for the ISR project for private use (Powertech, 2009a). The reclaimed land will be released for other uses. Restrictions on livestock grazing and recreational activities will be terminated. The land use impacts for disturbed areas will be MODERATE until vegetation is reestablished in seeded areas. Once vegetation is reestablished in reclaimed areas, the NRC staff conclude the land use impacts for the land application disposal option will be SMALL.

4.2.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the facility, the applicant will dispose of liquid waste by a combination of Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). For the combined option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis, depending on Class V injection well disposal capacity (Powertech, 2011). The land application option requires the construction and operation of irrigation areas and increased pond capacity for storage of liquid wastes during nonirrigation periods (see SEIS Section 2.1.1.1.2.4.2), whereas the Class V injection well disposal option requires the construction and operation of four to eight Class V injection wells (see SEIS Section 2.1.1.1.2.4.1). Therefore, the environmental impacts of land disturbance and access restrictions associated with the land application option are greater than those for the Class V injection waste disposal option than for all phases of the ISR process. Furthermore, only a portion of land application facilities and infrastructure (e.g., irrigation areas and storage ponds) will be constructed, operated, and decommissioned for the combination disposal option. Thus, the environmental impacts on land uses for the combined disposal option will be less than for the land application option alone and greater than for the Class V injection well disposal option alone. Therefore, NRC staff conclude that the environmental land use impacts of the combined Class V injection well and land application option for each phase of the proposed project will be bounded by the significance of environmental land use impacts of the Class V injection well disposal option and the land application disposal option as summarized in Table 4.2-2.

4.3 Transportation Impacts

As described in GEIS Section 4.4.3, potential environmental impacts from transportation to and from an ISR facility may occur during all phases of the facility lifecycle. Impacts will result from workers commuting to and from the site and from the shipment of construction equipment and materials, operational processing supplies, ion-exchange resins, yellowcake product, and waste materials. Impacts may also occur from fugitive dust emissions, noise, incidental wildlife or livestock kills, increased traffic on local roads, and from accidents. (NRC, 2009a)

GEIS Construction Phase Summary

NRC staff concluded in GEIS Section 4.4.2.1 that ISR construction activities will generate low levels of additional traffic (relative to local traffic counts) and will not significantly increase traffic or accidents on many of the roads in the region. Roads that have low traffic counts could be moderately impacted by the additional workers commuting during periods of peak employment. Additionally, NRC staff in the GEIS concluded that, depending on site-specific conditions, there could be a moderate impact from fugitive dust, noise, and incidental wildlife or livestock kills on, or near, site access roads. For these reasons, NRC staff concluded in the GEIS that the construction phase of ISR projects may result in transportation impacts that ranged from SMALL to MODERATE. (NRC, 2009a)

GEIS Operations Phase Summary

As described in GEIS Section 4.4.2.2, the low level of facility-related traffic during operations activities will not noticeably increase traffic or the occurrence of accidents on most roads, although local, less traveled roads could be moderately impacted during periods of peak employment. During the construction phase of ISR facilities there could be impacts from fugitive dust emissions, noise, and possible incidental wildlife or livestock kills either on or near site access roads as described in GEIS Section 4.4.1.1. (NRC, 2009a)

GEIS Section 4.4.2.2 also assessed the potential for and consequence from accidents involving the transportation of hazardous chemicals and radioactive materials. NRC staff in the GEIS recognized the potential for high consequences from a severe accident involving transportation of hazardous chemicals in a populated area. The probability of such accidents occurring was determined to be low because of the small number of shipments, comprehensive regulatory controls, and the applicant's use of best management practices (BMP). For radioactive material shipments [yellowcake product, ion-exchange resins, byproduct material], compliance with transportation regulations was expected to limit radiological risk for normal operations. The NRC staff concluded in GEIS Section 4.4.2.2 there will be a low radiological risk from transportation accidents. The use of emergency response protocols will help to mitigate the consequences of severe accidents that involved the release of uranium. NRC staff concluded in the GEIS that the potential environmental impact from transportation during operations may range from SMALL to MODERATE. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

NRC staff concluded in GEIS Section 4.4.2.3 that the magnitude of transportation activities during aquifer restoration will be lower than for the construction and operations phases. Aquifer-restoration-related transportation activities will be primarily limited to supply shipments, waste shipments, onsite transportation, and employee commuting. NRC staff concluded in the GEIS that transportation impacts from aquifer restoration will range from SMALL to MODERATE for the same reasons discussed previously for the operations phase. (NRC, 2009a)

GEIS Decommissioning Phase Summary

NRC staff concluded in GEIS Section 4.4.2.4 that transportation activities during decommissioning at ISR facilities and the potential impacts will be similar to the construction and operation phases, except the magnitude of transportation activities (e.g., number and types of waste and supply shipments, no yellowcake shipments) from decommissioning will be lower than for the operations phase. NRC staff concluded in the GEIS that the potential accident radiological risks from transportation during decommissioning will be bounded by the estimates of yellowcake transportation risk during operations based on the concentrated nature of the shipped yellowcake, the greater distance yellowcake is shipped compared to the byproduct material destined for a licensed disposal facility, and the number of shipments of yellowcake relative to byproduct material. NRC staff concluded in the GEIS the potential transportation impacts during decommissioning will be SMALL because of the reduced transportation activities. (NRC, 2009a)

Estimated transportation environmental impacts during the construction, operations, aquifer restoration, and decommissioning phases of the proposed ISR project are discussed next. Fugitive dust impacts are evaluated as air quality impacts in SEIS Section 4.7, noise impacts are described in SEIS Section 4.8, visual impacts are provided in SEIS Section 4.10, and potential impacts to livestock and wildlife are discussed in SEIS Section 4.6.1.1.2.

4.3.1 Proposed Action (Alternative 1)

The transportation activities for the proposed Dewey-Burdock ISR facility are described in SEIS Section 2.1.1.1.7. Under the proposed action, these activities include workers commuting to and from the site, and road transportation of construction equipment and materials, operational processing supplies, ion-exchange resins, yellowcake product, and waste materials. The applicant's preferred method for disposal of liquid byproduct material is by Class V injection well. If a permit is not obtained for Class V injection, the applicant will pursue land application of treated liquid effluent. If the capacity of either method is limited, the applicant will pursue a combination of both Class V injection and land application. The transportation impacts from the Class V injection well option are described in Section 4.3.1.1. The transportation impacts from the land application option and combined Class V injection and land application are described in Sections 4.3.1.2 and 4.3.1.3.

4.3.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid byproduct material is deep well disposal via Class V injection wells. The potential transportation environmental impacts from construction, operations, aquifer restoration, and decommissioning associated with the Class V injection well disposal option at the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.3.1.1.1 Construction Impacts

As described in SEIS Section 3.3, the site is accessed by Dewey Road (also known as Fall River County Road 6463 and Custer County Road 769) and State Highways 18, 79, and 89. The applicant estimated traffic generated by proposed construction activities, including transportation of equipment, supplies, and workers (Powertech, 2009a, 2010a), and its analysis is described in SEIS Section 2.1.1.1.7. The NRC staff's impact analysis first compared the proposed traffic estimates and data with the information evaluated in GEIS Section 2.8 and then evaluated the estimated percentage increase in existing traffic that could result from the proposed Dewey-Burdock ISR Project.

The NRC impact analysis found the overall magnitude of the proposed daily construction traffic is less than the construction traffic evaluated in GEIS Section 2.8. Commuting workers constitute the majority of road traffic the applicant described for the construction phase. The applicant estimated 38 worker trips to the site daily for the proposed project, which is well below the upper range of 200 commuting worker trips to a site considered in the GEIS. The applicant has estimated the initial facility construction requiring these workers will take approximately 1 year (Powertech, 2010a). The applicant's proposed equipment and supply shipments, however, were higher than those assumed in GEIS Section 2.8 (9 one-way trips per day for the proposed project compared to 0.24 one-way trips per day considered in GEIS Section 2.8). Table 4.3-1 compares the magnitude of the NRC staff's estimated local traffic counts from proposed construction activities with existing traffic counts on regional/local roads. Considering Table 4.3-1, the proposed traffic, if allocated completely to the individual road segments, will noticeably increase the existing traffic on low-traffic roads, such as unpaved Dewey Road (Fall River County Road 6463 and Custer County Road 769) and State Highway 89 but will not substantially increase traffic on more heavily traveled road segments, such as U.S. Highway 18 traveling from Edgemont or near Hot Springs or State Highway 79 at the junction with U.S. Highway 18. The projected daily traffic on Dewey Road, the road nearest the proposed site, represents a 42 percent increase over existing traffic considering both autos and trucks. State Highway 89 auto traffic was projected to increase by 13 percent if all workers commuted on that route and truck traffic was projected to increase 33 percent. Similarly, based on the traffic count information in Table 4.3-1, State Highway 89 is not a commonly used route for trucks; therefore, the projected increase in truck traffic from the proposed action is considered less likely to be concentrated there relative to other routes. While the projected increase in traffic on some road segments is a noticeable change in conditions, the NRC staff further evaluated the projected increases in traffic by considering the ability of the roads to accommodate the increased traffic. When the projected traffic for all the roads in the analysis is evaluated (ranging from 319 to 5,169 vehicles per day based on the sum of projected auto and truck traffic for each road), the magnitude of traffic is not expected to exceed the existing road capacity, and therefore the staff conclude the regional highways could accommodate the additional traffic from the proposed project.

The conclusion that existing road capacity will not be exceeded is based on the staff's consideration of other road capacity estimates in SEIS Section 3.3. Because the traffic projections in Table 4.3-1 are daily values for both directions of travel, the comparable one-way projected traffic is assumed to be half the tabulated values [e.g., 2,584 vehicles per day for the U.S. Highway 18 total of 5,169 (2,584 vehicles per day is well below the aforementioned range of capacities staff evaluated of 7,237 to 13,900 vehicles per day)]; therefore, the NRC staff conclude the highest projected traffic is below the estimated capacity.

Considering the magnitude of projected traffic from the proposed Dewey-Burdock ISR Project, the NRC staff conclude the increase in traffic volumes to the local and unpaved Dewey Road will result in SMALL impacts under the Class V injection well disposal option. This increase in traffic will incrementally accelerate degradation of the road surface, increase the generation of dust, and increase the potential for traffic accidents and wildlife or livestock kills. Based on the available capacity on the more distant regional roads, the staff conclude the potential traffic impacts to the remainder of regional roads under the Class V injection well disposal option will be SMALL.

The applicant intends to use existing roads on the site area to the degree possible; however, some new roads will be constructed to facilitate onsite transportation (SEIS Section 2.1.1.2.2). Impacts to land use related to the development of new access roads are addressed in SEIS Section 4.2.1.1. All roads constructed for the proposed action will be reclaimed except those landowners specify to remain for future use (Powertech, 2009a).

4.3.1.1.2 Operations Impacts

The proposed operational transportation activities for the Dewey-Burdock ISR Project are similar to those evaluated in GEIS Section 4.4.2.2 including employee commuting and truck shipments of yellowcake, ion-exchange resins, hazardous chemical supplies, and byproduct material. The types of impacts evaluated are also similar to those evaluated in the GEIS including impacts to traffic and potential hazards associated with shipment of yellowcake, ion-exchange resins, byproduct material, and hazardous materials.

Traffic generated by these proposed operations is described in SEIS Section 2.1.1.1.7. The overall magnitude of proposed operational transportation is less than the operational transportation evaluated in GEIS Section 4.4.2.2. Commuting workers constitute the majority of road traffic the applicant proposed for the operations phase. The applicant estimated a number of commuting workers trips to the site that was within the range considered in the GEIS (27 vehicle trips for the proposed project compared to 20 to 200 trips considered in the GEIS). For trucking activities, remote ion-exchange shipments were comparable to the GEIS Section 2.8 values and processing chemical shipments were less than GEIS values. The proposed operational byproduct shipments are less than the GEIS values, and proposed yellowcake shipments are at the low end of the range considered in the GEIS. (NRC, 2009a)

Table 4.3-2 compares the magnitude of the NRC staff's estimated increase in local traffic counts from proposed operations activities. The projected traffic for the operations phase for all road segments evaluated is lower than the projected traffic from the construction phase. Considering Table 4.3-2, the proposed traffic, if allocated completely to the individual road segments, will increase the existing traffic on unpaved Dewey Road (Fall River County Road 6463 and Custer County Road 769) but will not substantially increase traffic on more heavily traveled road segments, such as State Highway 89, U.S. Highway 18 (from Edgemont and near Hot Springs), or State Highway 79 at the junction with U.S. Highway 18. The projected daily traffic on Dewey

Road, the road nearest the proposed site, represents a 24 percent increase over existing traffic. State Highway 89 traffic was projected to increase by nine percent if all workers commuted on that route; however, because the road is more distant from the site, the NRC staff conclude it will be less likely to be used by all workforce commuters and therefore actual traffic impacts will be lower than projected. Based on the information in Table 4.3-2, the projected increases in truck traffic are low for all routes evaluated. Additionally, the magnitude of the projected operational traffic for all the roads evaluated (ranging from approximately 283 to 5,133 vehicles per day considering the sum of projected auto and truck traffic) will not exceed the existing road capacity (see additional discussion of capacity in SEIS Section 4.3.1.1), and the staff conclude the regional highways could accommodate the additional traffic from the proposed project. Considering the magnitude of projected traffic from the proposed Dewey-Burdock ISR Project, the NRC staff conclude the increase in traffic volumes to the local and unpaved Dewey Road will result in SMALL impacts under the Class V injection well disposal option. This increase in traffic will incrementally accelerate degradation of the road surface, increase the generation of dust, and increase the potential for traffic accidents and wildlife or livestock kills. Based on the available capacity on the more distant regional roads, the staff conclude the potential traffic impacts to the remainder of regional roads will also be SMALL under the Class V injection well disposal option.

The potential radiological accident risk associated with yellowcake product shipments was evaluated in GEIS Section 4.4.2.2. The yellowcake transportation analysis assumed shipment volumes that ranged from 34 to 145 yellowcake shipments per year, which could result in a risk of 0.01 and 0.04 latent cancer fatalities, respectively, considering accident probabilities and proposed Dewey-Burdock ISR Project are described in SEIS Section 2.1.1.1.7. These activities are similar in approach to the activities evaluated in the GEIS Section 4.2.2.2, and the quantities of material shipped, the number of shipments, and the shipment distances are within the magnitude of the yellowcake transportation activities evaluated in the GEIS. The applicant has estimated approximately 25 yellowcake shipments per year will be needed for the proposed action or an average of one shipment every 2 weeks. This estimate is based on the proposed 45,250 kg [1 million lb] annual yellowcake production rate and an assumed 18,100 kg [40,000 lb] capacity per yellowcake shipment (Powertech, 2009b). By comparison the GEIS does not differ significantly; it considers yellowcake shipped in drums that hold approximately 430 kg [950 lb] and shipments carrying 40 drums per load for a total shipment capacity of 17,200 kg [38,000 lb]. Therefore, the radiological accident risk associated with yellowcake shipment at the proposed Dewey-Burdock ISR Project will be bounded by the GEIS risk analysis. The shipment volume will not significantly affect the project-related traffic relative to the expected commuting workforce.

The GEIS Section 4.4.2.2 reported that previous accidents involving yellowcake releases result in up to 30 percent of shipment contents being released (NRC, 2009a). To limit the risk of an accident involving resin or yellowcake transport, the applicant has proposed that all such materials will be transported in accordance with U.S. Department of Transportation (USDOT) and NRC regulations, handled as low specific-activity materials, and shipped using exclusive-use-only vehicles (Powertech, 2009a). The NRC staff conclude the consequences of such accidents will also be limited because the applicant has proposed to develop emergency response procedures (Powertech, 2009a) for yellowcake and other transportation accidents that could occur during shipment to or from the proposed Dewey-Burdock ISR Project. The applicant also proposes to ensure its personnel and the carrier receive training on these emergency response procedures and that information about the procedures is provided to state and local agencies (Powertech, 2009a). Therefore, the NRC staff conclude the impact from a potential accident involving yellowcake transportation during the operations phase of the proposed project will be SMALL under the Class V injection well disposal option.

The potential impacts from ion-exchange shipments were evaluated in GEIS Section 4.2.2.2 as cited by GEIS Section 4.4.2.2. NRC staff concluded in the GEIS that the potential radiological impacts of these shipments will be bound by the risks from yellowcake shipments based on the less concentrated nature of the resins; the uranium being chemically bound to the resins, which will limit dispersion in the event of a spill; and the small shipment distance relative to yellowcake shipments (i.e., the likelihood of an accident increases with the distance traveled). The proposed ion-exchange transportation activities for the Dewey-Burdock ISR Project described in SEIS Section 2.1.1.1.7 are similar to the activities evaluated in the GEIS. The applicant plans to transport one loaded resin truck per day (Powertech, 2009a), which is consistent with the GEIS Section 2.8 assumption of one truck per day. Ion-exchange resin transported onsite between the Dewey site and the Burdock site central processing plant will traverse approximately 8 km [5.0 mi] of road (primarily on Dewey Road). Compliance with the applicable NRC and USDOT regulations for shipping ion-exchange resins, which are enforced by NRC onsite inspections, provides additional confidence that these materials can be safely shipped across the site area. Therefore, applying the GEIS impact analysis to the proposed activities, the NRC staff conclude the aforementioned SMALL potential radiological accident impacts from the proposed Dewey-Burdock facility yellowcake shipments bound the potential radiological accident impacts of the proposed ion-exchange resin shipments. The NRC staff conclude the resulting environmental impact from ion-exchange resin shipments will be SMALL; this is based on the fact that the risk of ion-exchange resin accidents is low, a resulting spill will be properly removed and disposed of, and the affected area will be reclaimed in accordance with applicable NRC and state regulations.
The potential impacts from operational byproduct material shipments were evaluated in GEIS Section 4.2.2.2 as cited by GEIS Section 4.4.2.2. NRC staff concluded in the GEIS the SMALL risks from transporting yellowcake during operations will bound the risks expected from byproduct material shipments, owing to the concentrated nature of shipped yellowcake, the longer distance yellowcake is shipped relative to byproduct material, and the relative number of shipments of each material. The proposed operational byproduct material transportation activities for the Dewey-Burdock ISR Project are described in SEIS Section 2.1.1.1.7. The applicant proposed to temporarily store operational byproduct material and then ship the material to an offsite disposal facility that is licensed to accept byproduct material. Byproduct material disposal facility options are described in SEIS Section 3.13.2. The applicant's estimated annual generation of 22 m^3 [29 yd^3] of byproduct material (including reverse osmosis reject solids, spent ion-exchange resins, and tank and pond sediments) will comprise approximately one shipment per year (SEIS Section 2.1.1.1.7). This magnitude of operational byproduct material shipping is lower than the range documented in the GEIS of 2.5 to 15 shipments per year (NRC, 2009a, Table 2.8-1). Transportation safety will be maintained by the applicant's proposed adherence to applicable NRC and USDOT transportation requirements, the applicant's proposed use of licensed third-party carriers, and the applicant's proposed emergency response measures (Powertech, 2009b). Based on the preceding analysis, the NRC staff conclude the applicant's proposed operational byproduct material shipment activities are consistent with the impact analysis in GEIS Section 4.4.2.2, and therefore environmental impacts of the proposed shipments under the Class V injection well disposal option will be bounded by impacts from the proposed yellowcake shipments (SMALL).

The potential impacts from transportation of process chemical supplies were also evaluated in GEIS Section 4.2.2.2 as cited by GEIS Section 4.4.2.2. The potential safety hazards associated with process chemicals the applicant intends to use for the proposed action (see SEIS Section 4.13.1.2.3) were also described and evaluated in GEIS Sections 2.11.2 and 4.2.11.2.4 (NRC, 2009a). The proposed operational hazardous chemical shipments for the Dewey-Burdock ISR Project are described in SEIS Section 2.1.1.1.7. The applicant proposes to store, use, and receive shipments of the following chemicals: sodium chloride ($NaCl$), sodium carbonate ($NaHCO_3$), sodium hydroxide ($NaOH$), hydrochloric acid (HCl), hydrogen peroxide (H_2O_2), carbon dioxide (CO_2), oxygen (O_2), anhydrous ammonia (NH_3), diesel fuel, gasoline, and bottled gases (Powertech, 2009b). The magnitude of operational chemical supply shipments is less than the value documented in the GEIS (NRC, 2009a, Table 2.8-1), and the types of chemicals shipped align with the materials evaluated in the GEIS (NRC, 2009a).

Transportation risks associated with incoming, onsite, and outgoing shipments involve potential in-transit accidents. The process chemicals described in the applicant's proposal are commonly used in industrial applications, and they will be transported following applicable USDOT hazardous materials shipping provisions. If an accident occurs, spill response will be handled via emergency response procedures, although a spill of nonradiological materials will be reportable to the appropriate state agency, EPA, and USDOT (NRC, 2009a). Spill material will be recovered or removed and the affected areas reclaimed. The release of anhydrous ammonia, a compound that the applicant may use in the precipitation circuit (Powertech, 2009b), could be hazardous to the public if released near a populated area. However, the proposed project is not situated in a populated area and the likelihood of such an accident on NUREG–0706 accident data (NRC, 1980). The applicant proposes to maintain transportation safety by following applicable USDOT hazardous materials transportation requirements and the proposed use of licensed third-party carriers (Powertech, 2009a). Based on these considerations, the staff conclude the environmental impacts from operational hazardous chemical shipments under the Class V injection well disposal option will be SMALL.

NRC staff conclude the increase in traffic volumes will result in SMALL impacts to the local and unpaved Dewey Road and SMALL impacts to the remaining regional roads under the Class V injection well disposal option. Based on the low radiological risks from transportation accidents and the implementation of the applicant's additional safety practices as previously discussed, the overall impacts from the proposed transportation activities during the operations phase will be SMALL under the Class V injection well disposal option.

4.3.1.1.3 Aquifer Restoration Impacts

At the proposed Dewey-Burdock ISR Project, commuting workers constitute the majority of road traffic the applicant proposes for the aquifer restoration phase. The applicant estimated the number of worker trips per day to the site will be five (compared to 20 to 200 worker trips per day considered in GEIS Section 2.8). To evaluate the potential traffic impacts, the NRC staff assumed remote ion-exchange and processing chemical shipments will be similar to the operations phase and bounded by the GEIS values (NRC, 2009a).

Table 4.3-3 compares the magnitude of the NRC staff's estimated increase in local traffic counts from proposed aquifer restoration activities. The projected auto traffic for the aquifer restoration phase for all road segments evaluated is lower than the projected traffic from the construction and operation phases, and the projected truck traffic is similar to the operation phase. Considering Table 4.3-3, the proposed traffic, if allocated completely to the individual road segments, will increase the existing traffic on low-traffic roads, such as the unpaved Dewey Road (Fall River County Road 6463 and Custer County Road 769), but will not substantially increase traffic on the remaining road segments in the table. The projected daily traffic on Dewey Road, the road nearest the proposed site, is a 4 percent increase over existing traffic. Based on the low levels of projected traffic for all vehicle types and road segments, the NRC staff conclude the transportation impacts from the proposed aquifer restoration transportation activities will be SMALL under the Class V injection well disposal option.

4.3.1.1.4 Decommissioning Impacts

The proposed decommissioning traffic estimates for the Dewey-Burdock ISR Project are described in SEIS Section 2.1.1.1.7. NRC staff derived these estimates from applicant-provided information. The magnitude of estimated truck transportation for the proposed decommissioning phase is about two times greater than what is reported in the GEIS (NRC, 2009a, Table 2.8-1), due to the larger amount of estimated nonhazardous solid waste (e.g., facility demolition and equipment removal) from the proposed action that will need to be shipped offsite for disposal. Despite this increase, the overall level of transportation is still low at about one truck per day (two trips when both directions are included) based on the information in SEIS Section 2.1.1.1.7.

Table 4.3-4 compares the magnitude of the NRC staff's estimated increase in local traffic counts from proposed decommissioning activities. The projected traffic in Table 4.3-4 is based on the applicant's proposed Class V injection well disposal option, which the applicant estimated will generate less decommissioning waste than the land application disposal option (and therefore will generate less truck traffic). The projected combined auto and truck traffic for the decommissioning phase for all road segments evaluated is lower than the projected traffic from the construction, operation, and aquifer restoration phases. Considering Table 4.3-4, the proposed traffic, if allocated completely to the individual road segments, will increase the existing traffic on low-traffic roads, such as the unpaved Dewey Road (Fall River County Road 6463 and Custer County Road 769), but will not substantially increase traffic on the remaining road segments in the table. The projected increase in daily traffic on Dewey Road, the road nearest the proposed site, is a six percent increase over existing traffic. Based on the low levels of projected traffic for all vehicle types and road segments, the NRC staff conclude the potential traffic-related impacts from the proposed decommissioning transportation activities will be SMALL under the Class V injection well disposal option.

Another potential transportation impact from proposed decommissioning activities is the radiological risk from the transportation of byproduct material for offsite disposal. The NRC staff consider the potential radiological accident risk associated with byproduct material shipments will be low based on the calculated risks from concentrated yellowcake product shipments discussed previously in SEIS Section 4.3.1.1.2 and in GEIS Section 4.2.2.2. The number of byproduct material shipments NRC staff estimated based on the applicant's proposal is low (Table 2.1-7) (approximately 31 annually for the Class V injection well option compared to

Table 4.3-3

Table 4.3-3. Estimated Daily Traffic on Regional Roads for the Aquifer Restoration Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

Road Segment	Traffic Count*			Projected Traffic†		Percent Increase‡	
	All Vehicles	Auto	Truck	Auto	Truck	Auto	Truck
Dewey Road	335	335	—	235	4	3	—
U.S. Highway 18 (Edgemont to State Highway 89)	1,782	1,361	421	1,371	425	<1	<1
U.S. Highway 18 (Hot Springs to State Highway 79)	5,075	4,725	350	4,735	354	<1	1
State Highway 89 (U.S. Highway 385 to U.S. Highway 18)	869	804	55	822	59	2	7
State Highway 79 (at U.S. Highway 18)	3,172	2,569	603	2,579	607	<1	<1

Sources: Powertech (2013a,b); SDDOT (2011)
*Traffic counts are annual average daily traffic for both directions of travel (Supplemental Environmental Impact Statement Section 3.3). The U.S. Nuclear Regulatory Commission calculated the auto traffic count as the difference between the all vehicle count and reported truck count. For Dewey Road, the auto count was assumed equal to the all vehicle count. Data for all roads are for year 2011 and are from SDDOT (2011), except the Dewey Road is from 2012 (Powertech, 2013a).
†Projected traffic is the sum of the proposed action daily two-way traffic and the applicable traffic count. Proposed aquifer restoration phase two-way traffic is double the round-trips reported in Table 2.1-7.
‡This analysis assumes all projected traffic will travel on each road. If proposed action traffic used multiple routes, then this analysis overestimates impacts to each road segment.

Table 4.3-4

Table 4.3-4. Estimated Daily Traffic on Regional Roads for the Decommissioning Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

Road Segment	2011 Traffic Count*			Projected Traffic†		Percent Increase‡	
	All Vehicles	Auto	Truck	Auto	Truck	Auto	Truck
Dewey Road	225	225	—	239	2	6	—
U.S. Highway18 (Edgemont to State Highway 89)	1,782	1,361	421	1,375	423	1	<1
U.S. Highway 18 (Hot Springs to State Highway 79)	5,075	4,725	350	4,739	352	<1	1
State Highway 89 (U.S. Highway 385 to U.S. Highway 18)	659	604	55	618	57	2	4
State Highway 79 (at U.S. Highway18)	3,172	2,569	603	2,583	605	<1	<1

Sources: Powertech (2013a,b); SDDOT (2011)
*Traffic counts are annual average daily traffic for both directions of travel (Supplemental Environmental Impact Statement Section 3.3). The U.S. Nuclear Regulatory Commission calculated the auto traffic count as the difference between the all vehicle count and reported truck count; for Dewey road, the auto count was assumed equal to the all vehicle count. Data for all roads are for year 2011 and are from SDDOT (2011), except the Dewey count is from 2012 (Powertech, 2013a).
†Projected traffic is the sum of the proposed action daily two-way traffic and the applicable traffic count. Proposed decommissioning phase two-way traffic is double the round-trips reported in Table 2.1-7.
‡This analysis assumes all projected traffic will travel on each road. If proposed action traffic used multiple routes, then this analysis overestimates impacts to each road segment.

145 yellowcake shipments evaluated in the GEIS; annual values for the proposed action are the product of the reported daily values in Table 2.1-7 and 260 days/year shipping frequency). The applicant's annual byproduct material volume estimate in its surety (Powertech, 2009b) (see SEIS Section 2.1.1.6.3) indicates the material will consist primarily of pond leak detection equipment and liners. Relative to powdered yellowcake, this material is in a form that will be less dispersible (i.e., less likely to cause public exposure if released) and easier to clean up if an accident involving release occurred. The byproduct material will be transported and disposed of at a licensed facility. The applicant has proposed to pursue an agreement with the White Mesa site in Blanding, Utah, for disposal of solid byproduct material (SEIS Section 3.13.2). The trip distance to this facility from the proposed site of 1,210 km [752 mi] is less than the distance used in the risk analysis described in GEIS Section 4.2.2.2 for transporting yellowcake to the conversion facility in Metropolis, Illinois {approximately 2,414 km [1,500 mi]}. The applicant proposes to implement additional BMPs to reduce the risk of accidents including (i) enforcing safe driving and emergency response procedures and training for personnel and truck drivers, (ii) installing communication systems to connect trucks to shipper/receiver/emergency responders, (iii) and enforcing speed limits on the proposed project site to increase driver safety and to reduce conflicts with big game, livestock, and other vehicles (Powertech, 2009a).
All shipments will be required to comply with applicable USDOT regulations governing the

transportation of radioactive material (including quantity limits, packaging requirements, and radioactive material transportation will be SMALL under the Class V injection well disposal option.

In conclusion, because of the low estimated traffic for the proposed Dewey-Burdock ISR Project relative to existing road traffic in the region surrounding the site, the NRC staff conclude the potential traffic-related transportation impacts during decommissioning will be SMALL under the Class V injection well disposal option. The low radiological risk from potential transportation accidents in comparison to the accident risks evaluated for the operation phase (i.e., no interstate transport of yellowcake product) supports the staff's conclusion that the radiological risks from transportation of decommissioning byproduct material for offsite disposal will also be SMALL. Therefore, the NRC staff conclude the overall transportation impacts related to the decommissioning phase will be SMALL under the Class V injection well disposal option.

4.3.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant proposes to dispose of liquid byproduct material generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). The potential transportation environmental impacts from construction, operations, aquifer restoration, and decommissioning associated with the land application liquid disposal option are discussed in the following sections.

4.3.1.2.1 Construction Impacts

The estimated daily traffic volume on regional roads for the construction phase for the land application option will be the same as that described in SEIS Section 4.3.1.1.1 and summarized in Table 4.3-1 for the Class V injection well disposal option. Commuting workers will constitute the majority of road traffic the applicant proposed for the construction phase. Considering Table 4.3-1, the proposed traffic will increase the existing traffic on low-traffic roads, such as Dewey Road, and State Highway 89 but will not substantially increase traffic on more heavily traveled road segments, such as U.S. Highway 18 traveling through Edgemont or near Hot Springs or State Highway 79 at the junction with U.S. Highway 18. As described in SEIS Section 4.3.1.1.1, when the projected traffic for all the roads in the analysis is evaluated (ranging from 319 to 5,169 vehicles per day based on the sum of projected auto and truck traffic for each road), the magnitude of traffic is not expected to exceed the existing road capacity. Therefore, NRC staff conclude the regional highways could accommodate the additional traffic from the proposed project.

Considering the magnitude of projected traffic from the proposed project, the NRC staff conclude the increase in traffic volumes to the local and unpaved Dewey Road will result in SMALL impacts under the land application disposal option. The projected daily traffic on Dewey Road represents a 42 percent increase over existing traffic considering both autos and trucks (see Table 4.3-1). This increase in traffic will incrementally accelerate degradation of the road surface, increase the generation of dust, and increase the potential for traffic accidents and wildlife or livestock kills. Based on the available capacity on the more distant regional roads, the NRC staff conclude the potential traffic impacts to the remainder of regional roads under the land application disposal option will also be SMALL.

The applicant intends to use existing roads on the site area to the degree possible; however, some new roads will be constructed to facilitate onsite transportation (SEIS Section 2.1.1.2.2). Impacts to land use related to the development of new access roads are addressed in SEIS Section 4.2.1.1. All roads constructed for the proposed action will be reclaimed except those landowners specify to remain for future use (Powertech, 2009a).

4.3.1.2.2 Operations Impacts

The proposed operational transportation activities for the Dewey-Burdock ISR Project include employee commuting and truck shipments of yellowcake, ion-exchange resins, hazardous chemical supplies, and byproduct material. Traffic generated by these proposed activities for the land application option will be the same as that described in SEIS Section 4.3.1.1.2 and summarized in Table 4.3-2 for the Class V injection well disposal option.

Commuting workers will constitute the majority of road traffic the applicant proposed for the construction phase. Considering Table 4.3-2, the proposed traffic will increase the existing traffic on low-traffic roads, such as Dewey Roadand State Highway 89 but will not substantially increase traffic on more heavily traveled road segments, such as U.S. Highway 18 traveling through Edgemont or near Hot Springs or State Highway 79 at the junction with U.S. Highway 18. As described in SEIS Section 4.3.1.1.2, when the projected traffic for all the roads in the analysis is evaluated (ranging from approximately 283 to 5,133 vehicles per day based on the sum of projected auto and truck traffic for each road), the magnitude of traffic is not expected to exceed the existing road capacity. Therefore, NRC staff conclude the regional highways could accommodate the additional traffic from the proposed project.

Considering the magnitude of projected traffic from the proposed project, the NRC staff conclude the increase in traffic volumes to the local and unpaved Dewey Road will result in SMALL impacts under the land application disposal option. The projected daily traffic on Dewey Road represents an increase of 24 percent over the existing traffic level (see Table 4.3-2). This increase in traffic will incrementally accelerate degradation of the road surface, increase the generation of dust, and increase the potential for traffic accidents and wildlife or livestock kills. Based on the available capacity on the more distant regional roads, the staff conclude the potential traffic impacts to the remainder of regional roads will also be SMALL under the land application disposal option.

Proposed yellowcake transportation activities for the land application option will be same as those described in SEIS Section 4.3.1.1.2 for the Class V injection well disposal option. The applicant has estimated approximately 25 yellowcake shipments per year will be needed for the proposed action or an average of one shipment every 2 weeks. This estimate is based on the proposed 45,250 kg [1 million lb] annual yellowcake production rate and an assumed 18,100 kg [40,000 lb] capacity per yellowcake shipment (Powertech, 2009b). This shipment volume will not significantly affect the project-related traffic relative to the expected commuting workforce.

To limit the risk of an accident involving resin or yellowcake transport, the applicant has proposed that all such materials will be transported in accordance with USDOT and NRC regulations, handled as low specific-activity materials, and shipped using exclusive-use-only vehicles (Powertech, 2009a). The NRC staff conclude the consequences of such accidents will also be limited because the applicant has proposed to develop emergency response procedures (Powertech, 2009a) for yellowcake and other transportation accidents that could occur during shipment to or from the proposed Dewey-Burdock ISR Project. The applicant also proposes to ensure its personnel and the carrier receive training on these emergency response procedures and that information about the procedures is provided to state and local agencies (Powertech, 2009a). Therefore, the NRC staff concluded the impact from a potential accident involving yellowcake transportation during the operations phase of the proposed project will be SMALL under the land application disposal option.

Proposed ion-exchange transportation activities for the land application option will be the same as those described in SEIS Section 4.3.1.1.2 for the Class V injection well option. The applicant plans to transport one loaded resin truck per day (Powertech, 2009a). Ion-exchange resin transported onsite between the Dewey satellite facility and the Burdock central processing plant will traverse approximately 8 km [5.0 mi] of road (primarily Dewey Road). Compliance with the applicable NRC and USDOT regulations for shipping ion-exchange resins, which are enforced by NRC onsite inspections, provides confidence that these materials can be safely shipped across the site area. The NRC staff conclude the aforementioned SMALL potential radiological accident impacts from the proposed Dewey-Burdock facility yellowcake shipments bound the potential radiological accident impacts of the proposed ion-exchange resin shipments. The NRC staff conclude that the resulting environmental impact from ion-exchange resin shipments will be SMALL; this is based on the fact that the risk of ion-exchange resin accidents is low, a resulting spill will be properly removed and disposed of, and the affected area will be reclaimed in accordance with applicable NRC and state regulations.

will be the same as those described in SEIS Section 4.3.1.1.2 for the Class V injection well disposal option. NRC staff concluded in the GEIS the small risks from transporting yellowcake during operations will bound the risks expected from byproduct material shipments, owing to the concentrated nature of shipped yellowcake, the longer distance yellowcake is shipped relative to byproduct material, and the relative number of shipments of each material. The applicant's estimated annual generation of 22 m^3 [29 yd^3] of byproduct material (including reverse osmosis reject solids, spent ion-exchange resins, and tank and pond sediments) will comprise approximately one shipment per year (SEIS Section 2.1.1.1.7). Transportation safety will be maintained by the applicant's proposed adherence to applicable NRC and USDOT transportation requirements, the applicant's proposed use of licensed third-party carriers, and the applicant's proposed emergency response measures (Powertech, 2009b). NRC staff conclude that the environmental impacts of the proposed byproduct material shipments under the land application disposal option will be bounded by impacts from the proposed yellowcake shipments (SMALL).

same as those described in SEIS Section 4.3.1.1.2 for the Class V injection well disposal option. Transportation risks associated with incoming, onsite, and outgoing hazardous chemical shipments involve potential in-transit accidents. The process chemicals described in the applicant's proposal are commonly used in industrial applications, and they will be transported following the applicable USDOT hazardous materials shipping provisions. If an accident occurred, spill response will be handled via emergency response procedures, although a spill of nonradiological materials will be reportable to the appropriate state agency, EPA, and USDOT (NRC, 2009a). Spill material will be recovered or removed and the affected areas reclaimed. The release of anhydrous ammonia, a compound that the applicant may use in the precipitation circuit (Powertech, 2009b), could be hazardous to the public if released near a populated area. However, the proposed Dewey-Burdock ISR Project is not situated in a populated area and the likelihood of such an accident occurring is SMALL, calculated as 3.0×10^{-7} accidents per km [4.8×10^{-7} accidents per mi] based on NUREG–0706 accident data (NRC, 1980). The applicant proposes to maintain transportation safety by adherence to applicable USDOT hazardous materials transportation requirements and the proposed use of licensed third-party carriers (Powertech, 2009a). Based on these considerations, the staff conclude the environmental impacts from operational hazardous chemical shipments under the land application disposal option will be SMALL.
NRC staff conclude the increase in traffic volumes to the local and unpaved Dewey Road will result in SMALL impacts from travel on that road and SMALL impacts to the remaining regional roads under the land application disposal option. Based on the low radiological risks from transportation accidents and the implementation of the applicant's additional safety practices as previously discussed, the overall impacts from the proposed transportation activities during the operations phase will be SMALL under the land application disposal option.

4.3.1.2.3 Aquifer Restoration Impacts
The estimated daily traffic volume on regional roads during the aquifer restoration phase for the land application disposal option will be the same as that described in SEIS Section 4.3.1.1.3 and summarized in Table 4.3-3 for the Class V injection well disposal option. Commuting

workers will constitute the majority of road traffic the applicant proposed for the aquifer restoration phase. The projected auto traffic for the aquifer restoration phase for all road segments evaluated is lower than the projected traffic from the construction and operation phases, and the projected truck traffic is similar to the operation phase. Considering Table 4.3-3, the proposed traffic, if allocated completely to the individual road segments, will increase the existing traffic on low-traffic roads, such as the unpaved Dewey Road (Fall River County Road 6463 and Custer County Road 769), but will not substantially increase traffic on the remaining road segments in the table. The projected daily traffic on Dewey Road, the road nearest the proposed site, is increased by four percent of the existing low level of traffic. Based on the low levels of projected traffic for all vehicle types and road segments, the NRC staff conclude the transportation impacts from the proposed aquifer restoration transportation activities will be SMALL under the land application disposal option.

4.3.1.2.4 Decommissioning Impacts

The proposed decommissioning transportation activities for the Dewey-Burdock ISR Project include employee commuting and truck shipments of nonhazardous solid waste (e.g., facility demolition and equipment removal) and byproduct material. Traffic generated by these proposed activities for the land application option will be the same as that described in SEIS Section 4.3.1.1.4 and summarized in Table 4.3-4 for the Class V injection well disposal option. The applicant estimated that the proposed land application disposal option will generate more decommissioning waste than the Class V injection well disposal option (and therefore will generate more truck traffic). The projected combined auto and truck traffic for the decommissioning phase for all road segments evaluated is lower than the projected traffic from the construction, operation, and aquifer restoration phases. Considering Table 4.3-4, the proposed traffic, if allocated completely to the individual road segments, will increase the existing traffic on low-traffic roads, such as the unpaved Dewey Road (Fall River County Road 6463 and Custer County Road 769), but will not substantially increase traffic on the remaining road segments in the table. The projected daily traffic on Dewey Road, the road nearest the proposed site, is increased by six percent of the existing low level of traffic. Based on the low levels of projected traffic for all vehicle types and road segments, the NRC staff conclude the potential traffic-related impacts from the proposed decommissioning transportation activities will be SMALL under the land application disposal option.

Another potential transportation impact from proposed decommissioning activities is the radiological risk from the transportation of byproduct material for offsite disposal. The NRC staff consider the potential radiological accident risk associated with byproduct material shipments will be low based on the calculated risks from concentrated yellowcake product shipments discussed previously in SEIS Section 4.3.1.2.2. The number of byproduct material shipments NRC staff estimated based on the applicant's proposal is low (Table 2.1-7; approximately 34 annually for the land application option). The applicant's annual byproduct material volume estimate in its surety (Powertech, 2009b) (see SEIS Section 2.1.1.6.3) indicates the material will consist primarily of pond leak detection equipment and liners. Relative to powdered yellowcake, this material is in a form that will be less dispersible (i.e., less likely to cause public exposure if released) and easier to clean up if an accident involving release occurred. The byproduct material will be transported and disposed of at a licensed facility. The applicant has proposed to pursue an agreement with the White Mesa site in Blanding, Utah, for disposal of solid byproduct material (SEIS Section 3.13.2). The trip distance to this facility from the proposed site of 1,210 km [752 mi] is less than the distance used in the risk analysis described in GEIS Section 4.2.2.2 for transporting yellowcake to the conversion facility in Metropolis, Illinois {approximately 2,414 km [1,500 mi]}. The applicant proposes to implement additional BMPs to reduce the risk of accidents, including (i) enforcing safe driving and emergency response procedures and training for personnel and truck drivers; (ii) installing communication systems to connect trucks to shipper/receiver/emergency responders; and (iii) and enforcing speed limits on the proposed project site to increase driver safety and to reduce conflicts with big game, livestock, and other vehicles (Powertech, 2009a). All shipments will be required to comply with applicable USDOT regulations governing the transportation of radioactive material (including quantity limits, packaging requirements, and conveyance dose rate limits). Based on the preceding analysis, the NRC staff conclude the potential radiological risks from the proposed transportation of decommissioning byproduct material will be low, and therefore the potential environmental impacts from the proposed radioactive material transportation will be SMALL under the land application disposal option.

In conclusion, because of the low estimated traffic for the proposed project relative to existing road traffic in the region surrounding the site, the NRC staff conclude the potential traffic-related transportation impacts during decommissioning will be SMALL under the land application disposal option. The low radiological risk from potential transportation accidents in comparison to the accident risks evaluated for the operation phase (i.e., no interstate transport of yellowcake product) supports the staff's conclusion that the radiological risks from transportation of decommissioning byproduct material for offsite disposal will also be SMALL. Therefore, the NRC staff conclude the overall transportation impacts related to the decommissioning phase will be SMALL under the land application disposal option.

4.3.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid byproduct material generated at the proposed Dewey-Burdock ISR Project, the applicant has proposed to dispose of liquid byproduct material by a combination of Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). For the combined option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the deep well disposal capacity (Powertech, 2011). The land application option will require the construction and operation of irrigation areas and increased pond capacity for storage of liquid byproduct material during nonirrigation periods (see SEIS Section 2.1.1.1.2.4.2), whereas the Class V injection well (see SEIS Section 2.1.1.1.2.4.1).

The relative volumes of byproduct material generated by the two disposal options differ during operations, aquifer restoration, and decommissioning phases with the land application option generating the larger amount of material for offsite disposal in each phase. The relative volumes of nonhazardous solid waste generated by the two disposal options differ during the decommissioning phase. The significance of these differences with regard to environmental impacts is low and does not change the impact conclusions for each disposal option. Therefore, the transportation environmental impacts associated with the land application option will be the same for the Class V injection well disposal option for all phases of the ISR process. Furthermore, only a portion of land application facilities and infrastructure (e.g., irrigation areas and storage ponds) will be constructed, operated, and decommissioned for the combined Class V injection well disposal and land application option. Therefore, the significance of environmental impacts on waste management resources for the combined disposal option will be less than for the land application option alone. Based on this reasoning, NRC staff conclude that the transportation environmental impacts of the combined Class V injection well disposal and land application option for each phase of the proposed Dewey-Burdock ISR Project will lie between or be bounded by the significance of environmental land use impacts of the Class V deep well injection option and the land application option as summarized in Table 4.3-5.@@

Table 4.3-1

Table 4.3-1. Estimated Daily Traffic on Regional Roads for the Construction Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

Road Segment	Traffic Count*			Projected Traffic†		Percent Increase‡	
	All Vehicles	Auto	Truck	Auto	Truck	Auto	Truck
Dewey Road	225	225	—	301	18	34	—
U.S. Highway 18 (Edgemont to State Highway 89)	1,782	1,361	421	1,437	439	6	4
U.S. Highway 18 (Hot Springs to State Highway 79)	5,075	4,725	350	4,801	368	2	5
State Highway 89 (U.S. Highway 385 to U.S. Highway 18)	659	604	55	680	73	12	33
State Highway 79 (at U.S. Highway 18)	3,172	2,569	603	2,645	621	3	3

Sources: Powertech (2013a,b); SDDOT (2011)
*Traffic counts are annual average daily traffic for both directions of travel (Supplemental Environmental Impact Statement Section 3.3). The U.S. Nuclear Regulatory Commission calculated the auto traffic count as the difference between the all vehicle count and reported truck count; for Dewey road, the auto count was assumed equal to the all vehicle count. Data for all roads are for year 2011 and are from SDDOT (2011), except the Dewey count is from 2012 (Powertech 2013a).
†Projected traffic is the sum of the proposed action daily two-way traffic and the applicable traffic count. Proposed construction phase two-way traffic is double the round-trips reported in Table 2.1-7.
‡This analysis assumes all projected traffic will travel on each road. If proposed action traffic used multiple routes then this analysis overestimates impacts to each road segment.

Table 4.3-2

Table 4.3-2. Estimated Daily Traffic on Regional Roads for the Operations Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

Road Segment	Traffic Count*			Projected Traffic†		Percent Increase‡	
	All Vehicles	Auto	Truck	Auto	Truck	Auto	Truck
Dewey Road	225	225	—	279	4	24	—
U.S. Highway 18 (Edgemont to State Highway 89)	1,782	1,361	421	1,415	425	4	<1
U.S. Highway 18 (Hot Springs to State Highway 79)	5,075	4,725	350	4,779	354	1	1
State Highway 89 (U.S. Highway 385 to U.S. Highway 18)	659	604	55	658	59	9	7
State Highway 79 (at U.S. Highway18)	3,172	2,569	603	2,623	605	2	<1

Sources: Powertech (2013a,b); SDDOT (2011)
*Traffic counts are annual average daily traffic for both directions of travel (Supplemental Environmental Impact Statement Section 3.3). The U.S. Nuclear Regulatory Commission calculated the auto traffic count as the difference between the all vehicle count and reported truck count; for Dewey road, the auto count was assumed equal to the all vehicle count. Data for all roads are for year 2011 and are from SDDOT (2011) except the Dewey count is from 2012 (Powertech, 2013a).
†Projected traffic is the sum of the proposed action daily two-way traffic and the applicable traffic count. Proposed operations phase two-way traffic is double the round- trips reported in Table 2.1-7
‡This analysis assumes all projected traffic will travel on each road. If proposed action traffic used multiple routes, then this analysis overestimates impacts to each road segment.

4.4 Geology and Soils Impacts

Environmental impacts on geology and soils occur during all phases of an ISR facility lifecycle; however, the direct impacts on geology and soils will be concentrated during construction (NRC, 2009a).

GEIS Construction Phase Summary

As described in GEIS Section 4.4.3.1, the principal impacts on geology and soils are caused by earthmoving activities during construction of ISR surface facilities, access roads, wellfields, and pipelines. Earthmoving activities affecting soils include ground clearing, topsoil removal, and preparation of land surfaces before construction of facility structures. Such structures include the processing plant, satellite facilities, header houses, access roads, drilling sites, land application areas, and associated structures. Excavating and backfilling trenches for pipelines and cables will also impact soils. (NRC, 2009a)

NRC staff concluded in the GEIS that the impact on geology and soils from construction activities is dependent on local topography, surface and bedrock geology, and soil characteristics. Earthmoving activities are normally limited to a small portion of the project. Consequently, earthmoving activities will result in SMALL and temporary disturbance of soils, impacts that are commonly mitigated using accepted BMPs. Construction activities will increase the potential for wind and water erosion due to the removal of vegetation and the physical disturbance that will result from vehicle and heavy equipment traffic. These activities, however, will result in SMALL impacts if equipment operators adopt construction BMPs to either prevent or substantially reduce erosion. (NRC, 2009a)

GEIS Operations Phase Summary

As discussed in GEIS Section 4.4.3.2, during ISR operations, a non-uranium-bearing (barren) solution or lixiviant is injected through wells into the mineralized zone. The lixiviant moves through the host rock, dissolving uranium and other metals. Production wells withdraw the resulting "pregnant" lixiviant, which now contains uranium and other dissolved metals, and pump it to a processing facility for further uranium recovery and purification. During ISR operations the removal of uranium and other metals will permanently change the composition of uranium-bearing rock formations. However, the uranium mobilization and recovery process in the target sandstones does not result in the removal of rock matrix or structure, and therefore no significant matrix compression or ground subsidence is expected. Consequently, impacts on geology from ground subsidence at ISR projects will be SMALL. (NRC, 2009a)

In GEIS Section 4.4.3.2, NRC staff discussed the potential soil impacts from ISR operations resulting from the need to transfer barren and pregnant uranium-bearing lixiviant to and from the processing facility in aboveground and underground pipelines. If a pipe ruptures or fails, lixiviant could be released and (i) pond on the surface, (ii) runoff into surface water bodies, (iii) infiltrate and adsorb in overlying soil and rock, or (iv) infiltrate and percolate to groundwater. In the case of spills from pipeline leaks and ruptures, licensees are expected to initiate immediate spill responses using onsite standard operation procedures (e.g., NRC, 2003b, Section 5.7). As part of the monitoring requirements at ISR facilities, licensees must report certain spills to NRC within 24 hours. Regular inspection and monitoring also occurs to minimize the potential for spills and leaks through early detection. (NRC, 2009a)

Additionally, failure of settling and holding pond liners or embankment systems and buildup of certain constituents in land-applied water may negatively impact soils (NRC, 2009a). Licensees will be expected to construct and monitor settling and holding pond liners and embankments in accordance with NRC-approved plans, and licensees will be expected to obtain the appropriate permits from state regulatory agencies for land application and to conduct regular soil monitoring. Such actions will tend to mitigate impacts to soils from these waste Section 4.4.3.2 that impacts to soils from spills during operations could range from SMALL to LARGE, depending on the volume of soil affected by the spill, but that the immediate response requirement to report spills at ISR facilities, the mandated spill recovery actions, and the required routine monitoring programs will reduce the potential impact from spills to SMALL. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

As described in GEIS Section 4.4.3.3, aquifer restoration programs typically use a combination of (i) groundwater transfer; (ii) groundwater sweep; (iii) reverse osmosis, permeate injection and recirculation; (iv) stabilization; and (v) water treatment and surface conveyance (NRC, 2009a). The groundwater sweep and recirculation process does not remove rock matrix or structure, nor will dewatering occur within the aquifer; therefore, no significant matrix compression or ground subsidence is expected. The water pressure in the aquifer decreases during restoration because a negative water balance must be maintained in the wellfield being restored to ensure water flows from the edges of the wellfield inward; this reduces the spread of contaminants outside of the wellfield. The influx of fluid will change the reservoir pressure but will not reactivate any local faults, because the change in reservoir pressure is limited by recirculation of treated groundwater. NRC staff concluded in the GEIS that ISR operations are unlikely to reactivate any local faults and are extremely unlikely to cause earthquakes. After analyzing these conditions the NRC staff concluded in the GEIS the environmental impact of aquifer restoration to the geology of the Nebraska-South Dakota-Wyoming Uranium Milling Region will be SMALL. (NRC, 2009a)

In GEIS Section 4.4.3.3, NRC staff also concluded impacts on soils from spills during aquifer restoration will range from SMALL to LARGE, depending on the volume of soil affected by the spill. Because of the requirements for immediate spill response at ISR facilities, for spill-recovery actions, and for routine monitoring programs, NRC staff concluded in the GEIS that impacts from spills will be temporary and the long-term impact on soils will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

As indicated in GEIS Section 4.4.3.4, the decommissioning of ISR facilities includes the following activities: (i) dismantling process facilities and associated structures; (ii) removing buried piping; and (iii) plugging and abandoning wells using accepted practices. The main impacts to the geology and soils at the project site during decommissioning will result from land reclamation activities and cleaning up contaminated soils. (NRC, 2009a)

The GEIS also states a licensee is required to submit a decommissioning plan to NRC for review and approval before decommissioning and reclamation activities may begin. NRC regulations require an applicant submit a final decommissioning plan to NRC for review and approval at least 12 months prior to the planned decommissioning of a wellfield or any portion of an ISR facility (NRC, 2003a). Any soils that have the potential to be contaminated will be surveyed to identify and clean up areas with elevated radionuclide concentrations, in accordance with NRC regulations at 10 CFR Part 40, Appendix A, Criterion 6 (6) (NRC, 2009a). The goal of reclamation is to return the site to preproduction conditions by replacing topsoil and reestablishing vegetation communities. (NRC, 2009a)

will be detectable but SMALL. Disruption and/or displacement of existing soils will be temporary and relatively small in scale. Changes in the size and location of impervious surfaces will be measureable, but will involve only a few hectares [acres] of compacted soil beneath buildings and parking lots. These changes will not be on a large enough scale to alter existing natural conditions. (NRC, 2009a)

4.4.1 Proposed Action (Alternative 1)

As described in SEIS Section 3.2, the proposed Dewey-Burdock ISR Project site encompasses

4,282 ha [10,580 ac] (Powertech, 2009a). The topsoil in the areas of the Burdock central processing plant and the Dewey satellite facility and wellfield header houses will be removed before construction begins. The applicant has committed to removing topsoil to construct access roads and will adhere to road construction practices stipulated by landowners (Powertech, 2009a). Over the life of the project, the applicant estimates that the area of topsoil to be stripped and removed will be up to 98 ha [243 ac] for the Class V deep well injection option and up to 175 ha [433 ac] for the land application disposal option (Powertech, 2012d). The area of topsoil disturbance will be approximately the same as the total disturbance area in the Class V deep well injection option but smaller than the 566 ha [1,398 ac] of estimated disturbance in the land application option (see Table 2.4-1), since topsoil generally will not be stripped from center pivot irrigation areas.

The following sections discuss the environmental impacts on land use for each of the liquid waste disposal options proposed by the applicant: (i) disposal via Class V injection wells, (ii) disposal via land application, or (iii) combined disposal via Class V injection wells and land application.

4.4.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid waste is deep well disposal via Class V injection wells. The potential environmental impacts on geology and soils from construction, operations, aquifer restoration, and decommissioning associated with the Class V injection well disposal option at the proposed project are discussed next.

4.4.1.1.1 Construction Impacts

As described in SEIS Section 2.1.1.1.2, topsoil will be removed from building sites, storage areas, and access roads and stored in designated topsoil stockpiles, in accordance with SDDENR requirements (Powertech, 2009b). The applicant will mitigate soil losses due to stormwater runoff and wind erosion. Mitigation measures will include (i) locating topsoil stockpiles away from drainage channels or other locations that will lead to loss of material, (ii) constructing berms around the base of the stockpiles, and (iii) seeding the stockpiles with an approved seed mix to minimize sediment runoff and wind erosion (Powertech, 2009a).

The applicant will implement additional mitigation measures to limit potential soil erosion impacts during construction at the proposed Dewey-Burdock site (Powertech, 2009a). These measures include (i) reestablishing temporary and permanent native vegetation as soon as possible after disturbance; (ii) decreasing stormwater runoff from disturbed areas by using structures to temporarily divert and/or dissipate surface stormwater runoff; (iii) retaining (iv) implementing drainage designs to minimize potential erosion and/or providing riprap or other soil stabilization controls; and (v) constructing stream crossings at right angles with adequate embankment and culvert installations to minimize erosion. Construction activities at the proposed Dewey-Burdock site have the potential to compact soils. Compaction of soils could lead to decreased infiltration and increased stormwater runoff. To mitigate the effects of compaction at the proposed site, the applicant proposes to disc and reseed any compacted soils as soon as possible after construction activities are completed (Powertech, 2009a).

During wellfield construction at the proposed Dewey-Burdock site, well construction, exploration drilling, and delineation drilling will also impact soils. The applicant estimated that approximately 646 wells (including delineation, monitor, production, injection, and deep disposal wells) will be drilled in the development of the initial wellfields in the Burdock and Dewey areas (Powertech, 2010b). As discussed in SEIS Section 2.1.1.1.2.3.5, drilling activities include the construction of unlined mud pits. During excavation of mud pits, topsoil will be separated from the subsoil and placed at a separate location (Powertech, 2009a). The subsoil will then be removed and placed next to the mud pit. Once use of the mud pit is complete (usually within 30 days of initial excavation), the applicant will redeposit the subsoil in the mud pit followed by topsoil replacement (Powertech, 2009a). The applicant will follow a similar approach for pipeline ditch construction.

The NRC staff conclude the environmental impacts to geology and soils from construction activities for the Class V injection well option at the Dewey-Burdock site will be SMALL. This finding is based on NRC staff evaluation of the limited area to be disturbed by construction, the applicant commitment to proposed BMPs to limit soil erosion and compaction, the commitment to mitigative methods, the short duration of construction, and the procedures used to construct mud pits and pipeline ditches.

While the NRC staff concludes impacts to soils from construction will be SMALL, the staff recognizes that alternative methods to manage drilling fluids are available that the applicant could choose to implement to further limit the potential impacts from the use of mud pits during well drilling activities. Alternatives or mitigating measures to the use of mud pits during well drilling operations include, for example, lining the mud pits with an impermeable membrane, offsite disposal of potentially contaminated drilling mud and other fluids, and the use of portable tanks or tubs to contain drilling mud and other fluids.

4.4.1.1.2 Operations Impacts

As described in SEIS Section 2.1.1.1.3, the applicant's operational activities at the facility are consistent with the operations analyzed in the GEIS. Soil disturbance during the estimated 8-year operations phase of the proposed Dewey-Burdock ISR Project will be limited primarily to earthmoving activities associated with wellfield development (e.g., preparing and constructing drill sites and mud pits, expanding pipelines, and constructing wellfield access roads). Therefore, the amount of soil disturbance resulting from earthmoving activities during the operations phase of the proposed project will be less than that for the construction phase.

As described in SEIS Section 2.1.1.1.3, the applicant's operational activities at the facility are consistent with the operations analyzed in the GEIS. The removal of uranium from the target sandstones in the initial wellfields at the proposed project will occur at depths ranging from approximately 122 to 244 m [400 to 800 ft] below ground surface (bgs) in the Dewey area and process and lixiviant chemistry will not remove rock matrix material in the ore-bearing sandstones. Therefore, no significant matrix compression will result from the proposed uranium recovery operations. Dewatering of the source uranium formations (i.e., the Fall River Formation and Chilson member of the Lakota Formation) during ISR operations is not expected. Hydrogeologic characteristics of the uranium source formations (i.e., formation thicknesses and potentiometric surfaces, as described in SEIS Section 3.5.3.2) and results of aquifer pumping tests at estimated production flow rates (see SEIS Section 4.5.2.1.1.2.2) indicate that drawdown in nearby wells will be SMALL. Because rock matrix is not removed during the uranium mobilization and recovery process and dewatering of uranium source formations is not expected, no subsidence is expected from the collapse of overlying rock strata into the ore zone.

In accordance with 40 CFR 144.28(f)(6)(i), for Class III injection wells, the operator must not exceed an injection pressure at the wellhead which will be calculated as to assure that the pressure during injection does not initiate fractures in the injection or confining zone. To ensure that formation fracture pressures are not exceeded, the applicant will estimate maximum allowable wellhead pressures at the proposed project on a well-by-well basis as a function of depth, fracture gradient, and injected fluid pressure gradient (Powertech, 2012g). The applicant will implement operational controls to prevent exceedance of estimated pressures. Based on the depths of target mineralization zones {approximately 61 to 244 m [200 to 800 ft]}, an expected fracture gradient of 15.8 kPa/m [0.7 psi/ft], and an expected fluid pressure gradient of 9.8 kPa/m [0.433 psi/ft] for the injected fluid, the applicant estimates that maximum allowable wellhead pressures at the proposed project will range from approximately 365 to 1,475 kPa [53 to 214 psi] (Powertech, 2012g). The applicant will also specify the maximum injection pressure for each header house (Powertech, 2012g). Maximum estimated injection pressures will be calculated as the lowest value of the following: (i) the lowest value of maximum allowable wellhead pressure for all injection wells connected to the header house based on fracture pressure calculations; (ii) the manufacturer-specified maximum operating pressure for the well casing; or (iii) the manufacturer-specified operating pressure of the injection piping and fittings. The anticipated range of injection pressures at each header house is 239 to 1135 kPa [20 to 150 psig] (Powertech, 2012g). At each header house, the designated maximum injection pressure will be posted and monitored to ensure the formation fracture pressure is not exceeded.

The applicant will implement an NRC-required wellfield and pipeline flow and pressure monitoring program to detect unexpected losses of pressure due to equipment failure, a leak, or a problem with well integrity (Powertech, 2009a). This program, described in SEIS Section 7.3.2, ensures timely detection of any releases from leaks due to pipeline breaks or ruptures and minimizes the volume of such releases. The design of all radium settling and holding ponds at the Dewey-Burdock ISR Project includes a leak detection system (Powertech, 2009b). Detection of a pond leak will initiate measures to take the pond out of use, transfer its contents to another pond, investigate the cause, and repair the condition causing the leak. The applicant will also collect and monitor soils for yellowcake and ion-exchange resin contamination along transportation routes and in wellfield areas where spills and leaks are possible (Powertech, 2009a). If soil is contaminated by a pipeline spill, pond leak, or vehicle accident, the applicant will remove the contaminated soil and dispose of it at a licensed disposal facility to ensure all impacts are temporary (Powertech, 2009a). After decontamination is complete, the applicant is required by regulation to conduct radiation surveys to confirm that soils have been cleaned to the NRC standards for unrestricted use in 10 CFR Part 20 (Powertech, 2009a).

As described in SEIS Section 2.1.1.1.2.4, for the applicant to use deep well disposal, an EPA Class V underground injection control (UIC) permit is required. EPA evaluates the suitability of formations proposed for deep well injection and only allows Class V injection where an applicant demonstrates liquid waste can be safely isolated in a deep aquifer. EPA reviews the application to confirm the well is properly sited, such that confining zones and proper well construction minimize the potential for migration of fluids outside the injection zone.

The NRC will require liquid wastes injected into potential Class V injection wells at the proposed project to be treated to meet release standards at 10 CFR Part 20, Subparts D and K, as wells as Appendix B, Table 2, Column 2. Before injection of fluids into the Class V deep injection wells, the permittee must demonstrate (i) the injection zones are not underground sources of drinking water by providing analytical results for total dissolved solids above 10,000 mg/L [10,000 ppm] and (ii) there are adequate confining zones above and below the proposed injection zones. If the proposed injection zones are underground sources of drinking water (have total dissolved solids concentrations below 10,000 mg/L [10,000 ppm], the applicant will be required to obtain an aquifer exemption from EPA, or the EPA UIC permit will require liquid wastes to be treated to meet drinking water standards or contaminant-specific background concentrations for constituents regulated under the Safe Drinking Water Act (SDWA). The permit will also place an injection pressure limit prohibiting injection pressures at or above the injection zone formation fracture pressure. The applicant estimates that the average injection pressure during active operations will range from approximately 2,068 to 5,515 kPa [300 to 800 psi] (Powertech, 2011; Appendix 2.7–L).

In summary, based on analysis of the depth of the ore production zones and because the operations phase does not involve the removal of rock matrix, the staff find that the impacts to geology from subsidence at the proposed project will be SMALL. Systems and procedures will be in place to monitor and clean up soil contamination resulting from pipeline and wellfield spills, pond leaks, and vehicle accidents. NRC and the EPA Class V permit conditions will require liquid wastes to be treated prior to deep well injection to meet NRC release standards in 10 CFR Part 20, Subparts D and K, and Appendix B, Table 2, Column 2. Unless the applicant applies for and is granted an aquifer exemption, the EPA UIC permit will require liquid wastes to be treated to meet drinking water standards or contaminant-specific background concentrations for constituents regulated under the SDWA. Therefore, NRC staff conclude that site-specific impacts to geology and soils during the operational phase for the Class V injection well disposal option will be SMALL.

4.4.1.1.3 Aquifer Restoration Impacts

For the Class V injection well disposal option, the primary method of aquifer restoration will be reverse osmosis (RO) treatment with permeate injection (see SEIS Section 2.1.1.1.4.1.1). About 70 percent of the water withdrawn from the wellfields and passed through high pressure RO membranes will be recovered as permeates. Before reinjection into the wellfields, the permeate will be supplemented with makeup water from wells in the Madison Formation and injected into the wellfields at an amount slightly less than the amount withdrawn to maintain a slight restoration bleed. Although a 1 percent restoration bleed will typically be used to maintain hydraulic control of wellfields, higher bleed rates may be implemented to recover flare (i.e., outward spreading) of lixiviant from the wellfield pattern areas during aquifer restoration. If necessary, the applicant has proposed to increase the restoration bleed by withdrawing up to one pore volume of water through groundwater sweep over the course of aquifer restoration.

will consist of bleed fluids from operating wellfields and the brine for the RO treatment system. The applicant estimates the maximum volume of liquid wastes injected into the Class V injection wells during aquifer restoration will be 567.75 Lpm [150 gpm] (see SEIS Section 2.1.1.1.4.1.1). The EPA UIC Class V permit will not place an upper limit on the injection rate; only the injection pressure will have an upper limit in the permit.

ISR activities during aquifer restoration at the proposed Dewey-Burdock facility will not remove rock matrix (NRC, 2009a). The source uranium formations lie 122 to 244 m [400 to 800 ft] bgs in the Dewey area and 61 to 122 m [200 to 400 ft] bgs in the Burdock area (Powertech, 2009a). Rock matrix is not removed by groundwater transfer and groundwater sweep during aquifer restoration. In addition, no significant matrix compression or ground subsidence is expected during aquifer restoration activities. For these reasons, the subsidence and collapse of overlying rock strata into the ore zone during the restoration phase is not expected. Therefore, the NRC staff conclude the environmental impact on geology during aquifer restoration will be SMALL.

The spill and leak detection program described for the operations phase in SEIS Section 4.4.1.1.2 will also be maintained during aquifer restoration because the plant and wellfield infrastructure will be used and monitored during aquifer restoration. The potential for spills and pipeline leaks to impact soils are SMALL and similar to impacts described for the operations phase. The NRC staff conclude that the potential for spills to impact the geology and soils is SMALL because of the regulatory requirements for immediate spill response, for implementing spill recovery actions, and for ongoing monitoring programs.

4.4.1.1.4 Decommissioning Impacts

The applicant will restore disturbed lands to their prior uses as livestock grassland and wildlife habitat (see SEIS Section 2.1.1.1.5). The Burdock central processing plant and Dewey satellite facilities will be decontaminated according to regulatory standards and the applicant's NRC-approved decommissioning plan (see SEIS Section 3.13.2). These structures will be demolished and trucked to a licensed disposal facility (see SEIS Section 2.1.1.1.5) or will be turned over to the landowner. Baseline readings of soils, vegetation, and radiological data will guide and provide a basis to evaluate final reclamation efforts. Any soils that have the potential to be contaminated will be surveyed to identify and clean up areas with elevated radionuclide concentrations, in accordance with NRC regulations at 10 CFR Part 40, Appendix A, Criterion 6 (6). Any contaminated soils will be disposed of in licensed disposal facilities. As discussed in SEIS Section 2.1.1.1.5.3, stockpiled topsoil will be redistributed over disturbed surfaces, which will be recontoured to match existing topography. Final revegetation will consist of seeding the area with a seed mixture approved by SDDENR, the local conservation district, BLM, and landowners (Powertech, 2009b).

Short-term impacts to geology and soils are expected as reclamation progresses; however, the result will be to return the land to uses that existed before proposed ISR activities began. The NRC staff conclude the environmental impacts of the decommissioning phase on geology and soils at the facility will be SMALL for several reasons. The temporary nature of the impacts on the land, the applicant's goal of decommissioning and reclaiming the site to preproduction conditions, and the fact that the magnitude of expected soil disturbance is within the range evaluated in the GEIS all support a finding of SMALL impacts.

4.4.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant will dispose of liquid waste generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). Environmental impacts on geology and soils from construction, operations, aquifer restoration, and decommissioning associated with the land application liquid waste disposal option are discussed in the following sections.

4.4.1.2.1 Construction Impacts

As described under SEIS Section 4.4.1.1.1, the applicant will implement mitigation measures to minimize soil losses from stormwater runoff and wind erosion of soil stockpiles. These measures include (i) locating topsoil stockpiles away from drainage channels or other locations that will lead to loss of material, (ii) constructing berms around the base of the stockpiles, and (iii) seeding the stockpiles with an approved seed mix to minimize sediment runoff and wind erosion. (Powertech, 2009a)

The mitigation measures to limit soil erosion impacts during construction of the land application disposal system will be the same as the Class V deep injection well disposal method described in SEIS Section 4.4.1.1.1 (Powertech, 2009a). These measures include (i) reestablishing temporary and permanent native vegetation as soon as possible after disturbance; (ii) decreasing stormwater runoff from disturbed areas by using structures to temporarily divert and/or dissipate surface runoff; (iii) retaining sediment within disturbed areas by using silt fencing, retention ponds, and hay bales; (iv) implementing drainage designs to minimize erosion and/or provide riprap or other soil stabilization controls; and (v) constructing stream crossings at right angles with adequate embankment and culvert installations to minimize erosion. Compaction of soils at the site could lead to decreased infiltration and increased stormwater runoff. The applicant plans to disc and reseed any compacted soils as soon as possible after construction activities are completed to mitigate compaction at the site (Powertech, 2009a).

Well construction, exploration drilling, and delineation drilling in the wellfield areas will also impact soils. The applicant estimates 642 delineation, monitor, production, injection, and deep disposal wells will be drilled as the initial wellfields in the Burdock and Dewey areas are developed (Powertech, 2010b). To prevent adverse impacts to groundwater quality, all production, injection, and monitoring wells, as well as all delineation drill holes, will be abandoned according to SDDENR regulations established in Administrative Rules of South Dakota (ARSD) 74:02:04:67 and 74:11:08 (Powertech, 2009a, 2012c). As discussed in SEIS Section 2.1.1.1.2.3.3, drilling activities will include the construction of unlined mud pits. Excavation of mud pits requires separating the topsoil from the subsoil and storing the topsoil at a separate location (Powertech, 2009a). The subsoil will be removed and placed next to the mud pit. Once use of the mud pit is complete (usually within 30 days of initial excavation), the applicant will redeposit the subsoil in the mud pit, followed by topsoil replacement (Powertech, 2009a). The applicant will follow a similar approach for pipeline trench construction.

The NRC staff evaluated the small area to be disturbed by construction, the applicant's plan to use BMPs to limit soil erosion and compaction, the short duration for construction, and use of mud pits and pipeline trenches and other construction methods that will limit environmental impacts. The NRC staff conclude that the environmental impacts to the geology and soils for the land application disposal option at the proposed project will be SMALL.

4.4.1.2.2 Operations Impacts

If land application is used to dispose of process-related liquid wastes, soils may be adversely impacted. The salinity of the treated wastewater could increase the salinity of soils (soil salinization) (NRC, 2009a), which will make the soil less permeable. In addition, land application of liquid wastes could cause radiological and/or other constituents (e.g., selenium and other metals) to accumulate in the soils and vegetation. Licensees of NRC-regulated ISR facilities are required to monitor and control irrigation areas (NRC, 2009a). The applicant proposes to collect and monitor soils and sediments for potential contamination in areas used for land irrigation (Powertech, 2009a). The applicant's land application monitoring program is described in SEIS Section 7.5. In addition, licensees must ensure that radioactive constituents in liquid effluents applied to land application areas are within allowable release limits (NRC, 2009a). NRC will require the applicant to treat liquid wastes applied to land application areas so they meet NRC release limit criteria for radionuclides, as referenced in 10 CFR Part 20, Appendix B. NRC will also require by license condition that the applicant conduct pre-operational and operational sampling of land application areas and the surrounding environment and report operational results to NRC semi-annually so NRC staff can evaluate existing conditions and trends. As stated in SEIS Section 2.1.1.1.6.2, land application will be carried out under a GDP approved by SDDENR (Powertech, 2012c). In accordance with permit program objectives, the applicant's proposed land application operations will have to meet applicable state standards for the protection of the environment including groundwater, soils, vegetation, biota, and wildlife. Both NRC and SDDENR have authority to request corrective actions or issue enforcement actions if standards or permit conditions are violated after operations begin. Because the monitoring and associated regulatory oversight by both NRC and SDDENR would be conducted for the duration of the proposed project, these activities would help to limit potential short-term and long-term impacts to soils. Finally, as described in SEIS Section 2.1.1.1.5, eventual decommissioning and reclamation activities after operations cease will further mitigate potential impacts to soils and restore vegetation prior to release of the site for other uses. Therefore, the NRC staff conclude that the environmental impacts to geology and soils while operating the land application disposal system for liquid wastes will be SMALL.

4.4.1.2.3 Aquifer Restoration Impacts

As described in SEIS Section 2.1.1.1.4.1.2, the primary method of aquifer restoration for the land application disposal option will be groundwater sweep with Madison Formation water injection (Powertech, 2011). The applicant estimates that typical liquid waste flow rates for the land application option during aquifer restoration will be approximately 1,892 Lpm [500 gpm]. None of the water recovered from the wellfields will be reinjected back into the wellfields. Makeup water for the Madison Formation will be injected into the wellfields at a flow rate sufficient to maintain the restoration bleed, which is typically 1 percent of the restoration flow rate (Powertech, 2011).

If land application is used to dispose of liquid wastes, soils at the proposed Dewey-Burdock Project will be impacted during aquifer restoration activities as the liquid evaporates. During aquifer restoration, the applicant continues routine soil monitoring for contamination of land application areas and must ensure that radionuclide contaminant levels do not exceed the release standards in 10 CFR Part 20, Appendix B and applicable state discharge requirements for land application of treated wastes. Routine monitoring and the inclusion of land application areas in decommissioning surveys provide environmental protections. Therefore, NRC staff conclude that impacts to soils from land application during aquifer restoration will be SMALL.

4.4.1.2.4 Decommissioning Impacts

If the land application disposal option is used, the environmental impacts of decommissioning the site will be similar to impacts described in SEIS Section 4.2.1.1.4 for the Class V injection well disposal option. Decommissioning of the site will follow an NRC-approved decommissioning plan, and all decommissioning activities must be carried out in accordance with 10 CFR Part 40 and other applicable federal regulatory requirements.

If the land application liquid waste disposal option is implemented at the Dewey-Burdock facility, the areas directly impacted by decommissioning will include the central processing plant, satellite facility, wellfields and their infrastructure (i.e., pipelines and header houses), irrigation areas, ponds, and access roads. SEIS Section 2.1.1.1.5 describes the decommissioning activities that will be undertaken to return the site to its previous land use. These include conducting radiological surveys; removing contaminated equipment and materials; cleaning up disturbed areas; plugging and abandoning wells; decontaminating, dismantling, and removing buildings and other onsite structures; and restoring disturbed areas (Powertech, 2009b). Land application areas will also be included in decommissioning surveys to ensure that soil concentration limits are not exceeded.

When decommissioning is complete, the land surfaces will be returned to their preextraction geologic condition. The NRC staff conclude the environmental impacts of the land application disposal option on the geology and soils for the land application option will be SMALL.

4.4.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA, but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the ISR facility, the applicant will dispose of liquid waste by a combination of disposal using Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). Under the combined disposal option land application, facilities and infrastructure will be constructed, operated, restored, and decommissioned, as needed, depending on the Class V injection well disposal capacity (Powertech, 2011).

The potential environmental impacts of liquid waste disposal by land application for all phases of the ISR process will be greater than for liquid waste disposal by Class V well injection because of the increased land disturbance, thereby increasing potential for soil disturbance and soil erosion. However, implementing the combined disposal option will result in only a portion of land application facilities and infrastructure being constructed, operated, and decommissioned. Therefore, the environmental impacts of the combined disposal option will be less than for the land application option alone, but greater than the Class V injection well disposal option alone. NRC staff conclude that the environmental impacts of the combined Class V injection well and land application disposal option for each phase of the project will be bounded by the effects of the individual disposal methods and therefore will be SMALL as summarized in Table 4.4-1.

5.6.2 Soils

5.6.2.1 Potential Soil Impacts

The two main drainage basins in the permit area have different soil types. The soil mapping unit descriptions are in Section 3.3. The Beaver Creek basin soils are composed of Haverson loam, with 0-2 percent slopes throughout the drainage. The Pass Creek basin soils are composed of Barnum silt loam in the south half of the drainage and Barnum-Winetti complex, with 0-6 percent slopes. The historical mine pits also were classified as Barnum silt loam and Barnum-Winetti complex.

Potential soil impacts to disturbed areas include:

- Compaction
- Loss of productivity
- Loss of soil
- Salinity
- Soil contamination

These impacts could potentially occur via:

- Clearing vegetation
- Compaction
- Excavation
- Leveling
- Redistribution of soil
- Stockpiling

Severity of potential impacts to soil is dependent upon type of disturbance, duration of disturbance and quantity of acres disturbed. Construction and operation activities have the potential to compact soils. Soils most sensitive to compaction, clay loams, are not present within the permit area; however, due to the use of heavy machinery and high volume within certain area, some soils have the potential for compaction. Compaction of the soil can lead to decreased infiltration, thereby increasing runoff. Soils compacted during construction and operations will be restored (i.e., disced and reseeded) as soon as possible following use.

Based on the soil mapping unit descriptions, the hazard for wind and water erosion within the permit area varies from negligible to severe. The potential for wind and water erosion is mainly a factor of surface characteristics of the soil, including texture and organic matter content. Given the very fine and clayey texture of the surface horizons throughout the majority of the permit area, the soils are more susceptible to erosion from water than wind.

If land application is used to dispose treated wastewater, there could be potential impacts to the soil from the buildup of salts, changes in SAR, buildup of radionuclides, buildup of metals and metalloids, and decrease in soil fertility. Mitigation of each of these potential impacts is described in the GDP and summarized in the following section.

Facility development will displace topsoil temporarily, which could adversely affect the structure and microbial activity of the soil. Loss of vegetation would expose soils and could result in a loss of organic matter in the soil. Excavation could cause mixing of soil layers and breakdown of the soil structure. Removal and stockpiling of soils for reclamation could result in mixing of soil profiles and loss of soil structure. Compaction of the soil could decrease pore space and cause a loss of soil structure as well. This could result in a reduction of natural soil productivity. Increased erosion and decreased soil productivity may cause a potential long-term declining trend in soil resources. Long-term impacts to soil productivity and stability could occur as a result of large-scale surface grading and leveling, until successful reclamation is accomplished. Reduction in soil fertility levels and reduced productivity could affect diversity of reestablished vegetative communities. Infiltration could be reduced, creating soil drought conditions. Vegetation could undergo physiological drought reactions (Lost Creek, 2007).

Overall, the potential environmental impacts to the soil within the permit area may be increased compared to areas outside the permit area but typically will not result from the ISR process itself, but rather from ancillary activities such as wastewater disposal and construction. The facility will be operated to minimize erosion and surface disturbance and then restored, leaving little impact on soils.

5.6.2.2 Mitigation of Potential Soil Impacts

The following measures will be used to minimize the potential impacts to soil resources.

• Design of facilities to minimize surface disturbance.

• Salvage and stockpile soil from disturbed areas (refer to Section 5.3.7).

• Reestablish temporary or permanent native vegetation as soon as possible after disturbance utilizing the latest technologies in reseeding and sprigging, such as hydroseeding (refer to Section 6.4.3.4).

• Decrease runoff from disturbed areas by using structures to temporarily divert and/or dissipate surface runoff from undisturbed areas (refer to Section 5.3.9).

• Retain sediment within the disturbed areas by using silt fencing, sediment ponds, and other ASCMs (refer to Section 5.3.9).

• Fill pipeline and utility trenches with appropriate material and regrade and reseed surface soon after completion.

• Drainage design will minimize potential for erosion by creating slopes less than 4 to 1 and/or provide rip-rap or other soil stabilization controls.

• Construct roads using techniques that will minimize erosion, such as surfacing with a gravel road base, constructing stream crossings at right angles with adequate embankment protection and culvert installation.

• Implement spill prevention and cleanup standard operating procedures to minimize soil contamination from vehicle accidents and/or well field spills or leaks; collect and monitor soils and sediments for potential contamination including areas used for land application, transport routes for yellowcake and ion exchange resins, and well field areas where spills or leaks are possible.

• Excavate contaminated soil as described in Section 6.3.3 and replace with uncontaminated soil as needed.

• Specific mitigation measures for potential soil impacts from land application are addressed in the GDP and summarized as follows:

o The expected land application water quality is described in Section 5.4.1.1.4.1. With an anticipated TDS concentration of 1,000 to 5,000 mg/L, the water will pose a low to moderate risk to the growth of moderately salt-sensitive crops such as alfalfa. Soil salinity levels will be controlled by blending the land application water in the ponds and by leaching salts below the root zone during land application. Powertech (USA) will operate the land application systems to balance the downward migration of water, which has potential alluvial groundwater impacts, with the leaching that will be used to control salt buildup in the root zone.

o The anticipated SAR levels in the land application water are 2 to 6, which should pose a low risk to soil infiltration rates. Should soil SAR increase and pose a risk to soil infiltration, Powertech (USA) will apply amendments such as sulfur or gypsum at agronomic rates.

o Since Powertech (USA) will treat the land application water to meet effluent limits, including the 10 CFR 20, Appendix B, Table 2, Column 2 standards for release of radionuclides to the environment, it is unlikely that radionuclides will build up to potentially harmful levels. This will be verified through operational soil monitoring and additional surveys during decommissioning.

o During decommissioning, Powertech (USA) will conduct land cleanup in accordance with NRC license and DENR permit requirements. This includes cleaning up surface soils to standards for radium-226 and natural uranium that will be established as conditions in the NRC license as protective of human health and the environment. This applies to the entire permit area and is not limited to the land application areas.

o The concentrations of metals and metalloids, including arsenic and selenium, are anticipated to be low as shown in Table 5.4-3 Nevertheless, there is potential for buildup of metals and metalloids over time in the land application areas. Potential impacts will be mitigated by monitoring soil concentrations during operations and implementing a contingency plan if concentrations approach trigger values. The contingency plan will consist of one or more of the following items:

 Verify sample results and precisely delineate affected areas through additional soil sampling and analysis.

 Modify land application system operating parameters to reduce the discharge rate in specific pivots or throughout the land application area.

 Implement water treatment if necessary for radionuclides, metals or metalloids.

 Implement a phytoremediation plan to control buildup of selenium in soil.

 Excavate soil contaminated above the reclamation standards established in the NRC license and LSM permit and dispose excavated soil in an appropriately permitted disposal facility.

o Powertech (USA) may apply fertilizer to the land application areas to maximize crop production and maintain adequate soil fertility.

4.5 Water Resources Impacts

4.5.1 Surface Water and Wetlands Impacts

As discussed in GEIS Section 4.4.4.1, potential environmental impacts to surface waters and wetlands may occur during all phases of the ISR facility lifecycle (NRC, 2009a). Impacts to surface waters and wetlands may result from (i) road construction and crossings; (ii) erosion runoff; (iii) spills or leaks of fuels, lubricants, and process-related fluids; (iv) stormwater discharges; and (v) discharge of wellfield fluids as a result of pipeline or well head leaks. Potential impacts to surface waters and wetlands may be greater in areas containing jurisdictional waters and wetlands.

GEIS Construction Phase Summary

NRC staff noted in the GEIS that impacts to surface waters and wetlands during the construction phase of ISR facilities may result from construction of road crossings, filling channels, surface erosion, and surface water runoff. Temporary changes to spring and stream flows due to grading and changes in topography and natural drainage patterns are other potential impacts. U.S. Army Corps of Engineers (USACE) permits under Section 404 of the Clean Water Act are required for placing fill, excavating, or using earthmoving equipment to clear land in jurisdictional wetlands or waters of the United States (WUS). As a result of the USACE permitting process, impacts are expected to be mitigated through various mitigation options, such as banking and riparian/wetland enhancement. Potential impacts to surface waters and wetlands also include accidental spills or leaks of fuels and lubricants from construction equipment and stormwater runoff from limited impervious areas including buildings, roads, and parking areas that infiltrates and recharges shallow aquifers. NRC staff determined in the GEIS that these potential impacts will be temporary and mitigated through proper planning and design, the use of proper construction methods, and the implementation of BMPs, or restoration after the construction phase. Thus, NRC staff concluded in the GEIS that compliance with applicable federal and state regulations and permit conditions and the implementation of BMPs and other mitigation measures will result in potential impacts to surface water and wetlands during construction that will be SMALL. (NRC, 2009a)

GEIS Operations Phase Summary

The expansion of facilities or pipelines during the operations phase may result in impacts comparable to those described for the construction phase. The impacts to surface water and wetlands during operation activities may also involve accidental spills or leaks of process-related water and the discharge of stormwater runoff and process-related water. The impact from spills on surface waters and wetlands will be comparable to those described for the construction phase and will be dependent on the size of the spill, the success of remediation, the use of the surface water, proximity of the spill to surface water, and the volume of discharge to the surface waters. NRC staff noted in the GEIS that during operational activities, federal and state agencies regulate the discharge of stormwater runoff and process-related water through the permitting process, and hence, the impacts from permitted discharges will be mitigated through permit conditions. For these reasons, NRC staff concluded in the GEIS that impacts to surface waters and wetlands during operations will be SMALL to MODERATE. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

NRC staff noted in the GEIS impacts to surface waters and wetlands during the aquifer restoration phase may result from (i) produced water, (ii) stormwater runoff and accidental spills, and (iii) brine reject from the reverse osmosis system. NRC staff concluded in the GEIS the impacts from these activities will be similar to the impacts from operations, because the infrastructure will be in place and similar activities will be conducted (e.g., wellfield operation, transfer of fluids, water treatment, stormwater runoff). For these reasons, NRC staff concluded in the GEIS that aquifer restoration impacts on surface waters and wetlands will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

NRC staff concluded in the GEIS that surface water and wetland impacts from decommissioning will be similar to the impacts from construction. The activities to clean up, recontour, and reclaim disturbed lands during decommissioning will mitigate long-term impacts to surface waters and wetlands. NRC staff concluded in the GEIS that the potential impacts to surface waters and wetlands from decommissioning will be SMALL. (NRC, 2009a)

Potential environmental impacts to surface water and wetlands from construction, operations, aquifer restoration, and decommissioning for the proposed Dewey-Burdock ISR project are discussed in the following sections.

4.5.1.1 Proposed Action (Alternative 1)

As described in SEIS Section 3.5.1, the proposed Dewey-Burdock ISR Project lies within the Beaver Creek watershed, which includes Beaver Creek, Pass Creek, and their tributaries. Beaver Creek is a perennial stream, and its tributaries have ephemeral flow depending on the amount of precipitation. Pass Creek and its tributaries are dry for most of the year, except for Creeks are not used for domestic water supply within the proposed project area, but water from Beaver Creek is used for local irrigation.

There are a number of abandoned open pit mines stretching from the eastern to the northern boundaries of the site in the Burdock area (see Figure 3.2-3). With the exception of Darrow Pit #2 and the Triangle Pit, the abandoned pits are usually dry. The Triangle Pit has permanent water storage at a depth greater than 30 m [100 ft]. The Triangle Pit is below the potentiometric surface of the Fall River Formation and is, therefore, hydraulically connected to the Fall River Formation. Water in the Triangle Pit has elevated dissolved uranium and gross alpha concentrations exceeding EPA-regulated maximum contaminant levels (MCLs) and is not used as a livestock or domestic water supply (see SEIS Section 3.12.1).

USACE identified 20 wetlands within the proposed project area (see SEIS Section 3.5.2), of which only 4 were considered jurisdictional: Beaver Creek, Pass Creek, and an ephemeral tributary to each. The jurisdictional ephemeral tributary to Beaver Creek has wetlands present near its confluence with Beaver Creek located in Section 32, Township 6 South, Range 1 East (Figure 4.5-1). The drainage area for this tributary includes surface facilities, infrastructure, and wellfields constructed in the Dewey area. The jurisdictional ephemeral tributary to Pass Creek has wetlands present near its confluence with Pass Creek located in Section 3, Township 7 South, Range 1 East (Figure 4.5-1). The drainage area for this tributary includes surface facilities, infrastructure, and proposed wellfields in the Burdock area.

The environmental impacts on surface waters and wetlands for each of the applicant-proposed liquid waste disposal options (i.e., disposal via Class V injection wells, disposal via land application, or disposal via combination of Class V injection wells and land application) are discussed in the following sections.

4.5.1.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells. The Class V injection wells, if permitted by EPA, will be near the satellite plant in the Dewey area and near the central processing plant in the Burdock area (see Figure 2.1-10). Potential environmental impacts to surface waters and wetlands from construction, operation, aquifer restoration, and decommissioning associated with the Class V injection well disposal option at the proposed project are discussed in the following sections.

4.5.1.1.1.1 Construction Impacts

The NRC staff evaluated the occurrence of surface water and wetlands and found it to be limited in area and quantity; Pass Creek and the tributaries to both Pass Creek and Beaver Creek are ephemeral and often dry. As described in SEIS Section 4.2.1.1, the deep well liquid waste disposal option is estimated to disturb 98.3 ha [243 ac] of land or 2.3 percent of the permit area (Powertech, 2010a). Land disturbance will result from construction of facilities, pipelines, initial wellfields, radium settling and holding ponds, Class V injection wells, and access roads (see Figure 4.2-1). The applicant is required to obtain construction and industrial stormwater National Pollutant Discharge Elimination System (NPDES) permits in accordance with SDDENR regulations in ARSD Chapter 74:52. The NPDES permit requirements for discharges to surface water, as established in ARSD 74:52, will control the amount of pollutants that can enter surface water bodies, such as streams, wetlands, and lakes. The applicant has not yet submitted an NPDES permit application (see Table 1.6-1).

The Burdock central plant and Dewey satellite facility and supporting buildings will be constructed outside the 100-year floodplain of Pass and Beaver Creeks and away from other small ephemeral drainages (see SEIS Section 3.5.1). These buildings will be located on relatively flat terrain, which will require minimum soil movement to create level pads for the Burdock central plant area and the Dewey satellite facility area to natural drainages (Figure 4.5-1). Facility buildings will be located away from these intermittent drainage channels and outside of floodplains so facilities will not flood. If an accidental spill occurs during the construction phase, the applicant will promptly mitigate it by following surface water monitoring and spill response procedures, which will be established as part of the NPDES permit (Powertech, 2009a).
Although facility buildings at the proposed project site will be outside the 100-year floodplain of Pass and Beaver Creeks and small ephemeral drainages, other facilities (e.g., storage ponds), infrastructure (e.g., access roads and the plant-to-plant pipeline), and wellfields will be within the 100-year floodplain of Pass and Beaver Creeks and small ephemeral drainages (see SEIS Section 3.5.1). To protect facilities and infrastructure from flood damage and avoid discharges from storage ponds that are located within the 100-year inundation boundary, the applicant proposes a system of structures, such as straw bales, collector ditches, and engineered diversion structures or berms (Powertech, 2011).

Applicant-proposed measures to protect against flooding in the wellfields include (i) locating above-grade wellfield infrastructure outside the 100-year flood inundation boundary, (ii) constructing diversion or erosion control structures to divert flow and protect any well heads placed within the 100-year inundation boundary, and (iii) sealing all well heads to withstand brief periods of submergence. All pipelines, including the proposed plant-to-plant pipeline, will be buried below the frost line and, therefore, will not be impacted by flooding (Powertech, 2011).
The applicant will use a phased approach to wellfield development. The Burdock B-WF1 wellfield and Dewey D-WF1 wellfield will be constructed during the initial construction phase of the project (Figure 4.5-1). Wellfield B-WF1 will be situated at least 1,006 m [3,300 ft] from Pass Creek and the ephemeral tributary to Pass Creek identified as a jurisdictional wetland. Wellfield D-WF1 is located at least 101 m [330 ft] north of Beaver Creek and 305 m [1,000 ft] northwest of the ephemeral tributary to Beaver Creek, which is a jurisdictional wetland (see Figure 4.5-1). However, wellfield D-WF1 crosses over ephemeral tributaries upstream of the tributary to Beaver Creek identified as a jurisdictional wetland.
Additional wellfields will be built and developed in phases as operations in preceding wellfields become uneconomical. Figure 4.5-1 shows that Dewey wellfield D-WF2 and a portion of Dewey wellfield D-WF4 are located 101 m [330 ft] north of the ephemeral tributary to Beaver Creek identified as a jurisdictional wetland. However, like wellfield D-WF1, wellfields D-WF2 and D-WF4 cross over ephemeral tributaries upstream of the tributary to Beaver Creek identified as

a jurisdictional wetland. Figure 4.5-1 also shows that Burdock wellfields B-WF9 and B-WF10 cross nearby ephemeral tributaries upstream of Pass Creek. In addition, Figure 4.5-1 shows that the ephemeral tributary to Pass Creek identified as a jurisdictional wetland bisects wellfield B-WF5.

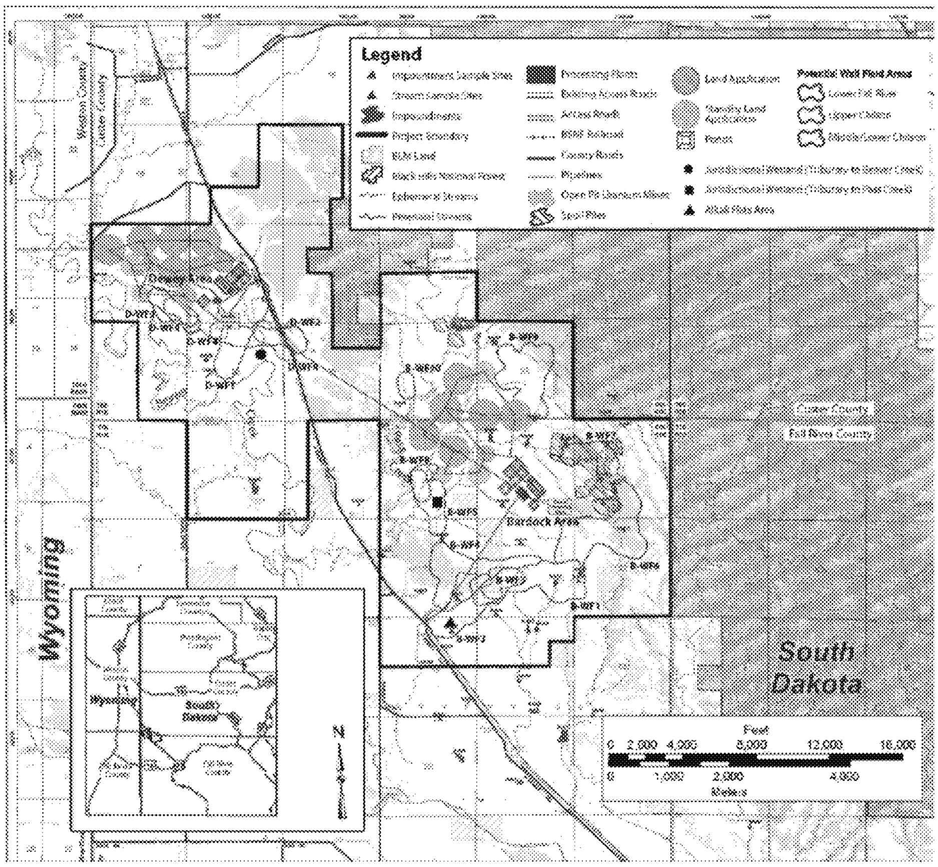

Figure 4.5-1. Map Showing Locations Identified as Jurisdictional Wetlands on Ephemeral Tributaries to Beaver Creek (Black Circle) and Pass Creek (Black Square) and Their Relation to Proposed Site Facilities in the Proposed Dewey-Burdock *In-Situ* Recovery Project Area Source: Modified From Powertech (2011)

USACE permits under Section 404 of the Clean Water Act are required for placing fill material, excavating, or using earthmoving equipment to clear land in wetlands or WUS. The presence of wellfields within jurisdictional wetlands and crossing tributaries upstream of jurisdictional wetlands may require the applicant to obtain USACE permits before construction activities (e.g., drilling wells, laying pipeline, and constructing access roads). In addition, the applicant's plantto-plant pipeline crosses Pass Creek between wellfields B-WF9 and B-WF10 in the Burdock construction. The USACE permitting process ensures that proper filling and dredging techniques are used and proper mitigation measures are defined and implemented to ensure protection of wetland habitat and water quality in affected jurisdictional wetlands. The applicant has committed to seek authorization from USACE and comply with Section 404 permitting requirements before conducting work in jurisdictional wetlands identified in the project area (Powertech, 2009a). At this time, the applicant has not applied for a Section 404 permit. Therefore, USACE has not conducted additional Section 404 permitting activities at the proposed project site, such as determining specific acreages of jurisdictional wetlands that could be impacted or identifying mitigation measures to be implemented to minimize wetland impacts. Construction activities may generate a limited amount of surface water runoff. The applicant indicates surface waters will not be consumed and long-term discharge to surface waters will not occur during construction (Powertech, 2009a). The applicant will implement a stormwater pollution management plan (SWMP) to control stormwater runoff during construction and to ensure that surface water runoff from disturbed areas will not contaminate surface waters and wetlands (Powertech, 2009a). SWMP control measures will (i) minimize disturbance of surface areas, drainage channels, and vegetation; (ii) employ grading to direct stormwater runoff away from water bodies; (iii) use riprap at intersections to make bridges and culverts more effective; (iv) stabilize slopes; (v) avoid unnecessary off-road travel; (vi) provide rapid response cleanup procedures and training for potential spills; (vii) require storage of hazardous materials and chemicals in bermed or curbed areas; (viii) place surface piping outside identified 100-year floodplain levels; and (ix) build curbs around facilities and structures to control process fluid spills.

option are shown in Figure 2.1-10. As described in SEIS Section 2.1.1.1.2.4, radium settling and holding ponds will be constructed with linings that meet the requirements of NRC regulations in 10 CFR Part 40, Appendix A, Criterion 5 (NRC, 2003b, 2008). Approved construction uses liners, underdrains, and a leak detection system to identify and reduce the impact on the environment from any leaks.

Because the applicant has committed to (i) implementing mitigation measures to control erosion, stormwater runoff, and sedimentation; (ii) complying with USACE Section 404 permitting requirements for wetlands; (iii) complying with NPDES permit requirements for discharge to surface waters; and (iv) following NRC regulations concerning the construction of settling and holding ponds (e.g., use of liners, underdrains, and leak detection systems), NRC finds impacts to surface waters and wetlands during the construction phase to be SMALL.

4.5.1.1.1.2 Operations Impacts

The NRC staff has considered site-specific hydrological factors in assessing environmental impacts to surface water and wetlands during ISR operations in conjunction with the deep well disposal of liquid wastes option. The staff evaluated the occurrence of surface water and wetlands and found it to be limited in area and quantity. Beaver Creek is a perennial stream and does not bisect any wellfields in the Dewey area. Pass Creek and tributaries of Pass and Beaver Creeks have ephemeral surface water flows.

As described in SEIS Section 3.5.3.3, the Fall River and Chilson aquifers make up the Inyan Kara Group aquifer and contain the uranium mineralization that will be extracted at the proposed project (Powertech, 2009a). Beaver and Pass Creeks do not have a natural hydraulic connection with the underlying Fall River and Chilson aquifers across the Dewey-Burdock site.

However, standing water in the Triangle Pit in the Burdock area is hydraulically connected to the Fall River Formation. In addition, pumping tests in the Burdock area indicated a certain degree of hydraulic communication between the Fall River aquifer and Chilson aquifer through the intervening Fuson Shale (see SEIS Section 3.5.3.2). Because the Triangle Pit is not a source of water for domestic use or livestock watering due to its poor water quality [specifically, elevated uranium and gross alpha concentrations exceeding EPA-regulated MCLs for drinking water (see SEIS Section 3.12.1)], the potential environmental impacts to the standing water at the abandoned Triangle Pit mine during ISR operations in conjunction with the Class V injection well disposal option will be SMALL.

As described in SEIS Section 3.5.1, groundwater from the Fall River and Chilson aquifers is discharging to the ground surface through improperly plugged exploratory boreholes at an area in the southwest corner of the Burdock area known as the "alkali flats" (Powertech, 2011). This area is within the proposed B-WF2 wellfield (see Figure 4.5-1). Although the alkali flats area is located outside the drainage areas of Beaver and Pass Creeks, it is near surface impoundments used for stock watering. As described in SEIS Sections 2.1.1.1.2.3.3 and 2.1.1.1.2.3.4, prior to wellfield development, the applicant proposes to identify and evaluate unplugged and improperly sealed boreholes using delineation drilling and wellfield pump testing. Based on the results of the delineation drilling and pump testing, the applicant will plug or otherwise mitigate the potential effects of any boreholes that will potentially affect surface waters and wetlands during ISR operations (Powertech, 2011).

The Class V injection well disposal option involves injecting process-related effluents into the Deadwood and Minnelusa Formations, which lie below the Morrison Formation (Powertech, 2011, Appendix 2.7L). The depth from the ground surface to the disposal horizon for the first 4 Class V injection wells ranges from 492 to 1,076 m [1,615 to 3,530 ft] (Powertech, 2011; Appendix 2.7L). As described in SEIS Section 2.1.1.1.2.4, an EPA Class V UIC permit is required for the applicant to use deep well disposal. EPA will evaluate the suitability of the formations proposed for Class V well injection. Class V injection disposal will be allowed only if the applicant demonstrates liquid waste can be isolated safely in a deep aquifer. In the Dewey-Burdock area, there is no evidence of any hydraulic connection between surface waters and proposed aquifers for the Class V injection well disposal option. Therefore, the potential environmental impacts to surface waters and wetlands from the Class V injection well disposal option during ISR operations will be SMALL.

In addition to site-specific hydrological information and a Class V deep well injection permit, the NRC staff have considered other permit requirements and mitigation measures to which the applicant has committed in assessing environmental impacts to surface water and wetlands during ISR operations in conjunction with the Class V injection well disposal option. The applicant will construct the central plant and satellite facility on concrete slabs surrounded by protective berms or curbs to contain and control accidental spills. Permitted discharge of processing effluents to surface waters will not be undertaken. Earthmoving activities sufficient to generate surface water runoff will not take place. The applicant will use its delineation drilling and pump testing program to identify and plug improperly sealed boreholes that may impact surface waters. The applicant will implement SWMP as part of the NPDES permit in accordance with SDDENR requirements to detain and treat stormwater runoff for these facilities and to ensure that runoff does not contaminate surface waters and wetlands (Powertech, 2009a). The SWMP will identify and evaluate routes by which spills could leave the facility and lay out BMPs as preventative measures to minimize stormwater contamination. Stormwater runoff will be diverted away from the facility and absorbed into soils. The applicant has committed to implement mitigation measures to control erosion and sedimentation, as part of the SWMP. The applicant will implement an emergency response plan to identify and clean up accidental spills and leaks (Powertech, 2009a). Pipelines will be buried to avoid freezing, and pipeline pressure will be monitored to detect leaks.

In conclusion, based on the aforementioned hydrological factors and the applicant's commitment to comply with permit requirements, the NRC staff conclude that environmental impacts to surface waters and wetlands from ISR operations in conjunction with the Class V injection well disposal option will be SMALL.

4.5.1.1.1.3 Aquifer Restoration Impacts

As described in SEIS Section 2.1.1.1.4.1.1, the primary method of aquifer restoration for the Class V deep injection well option is RO treatment with permeate injection. The RO reject, or brine, will undergo radium removal in the radium settling ponds and then will be disposed of in deep Class V injection wells. Under the EPA Class V UIC permit, deep well disposal of treated liquid wastes must not lead to concentration levels of hazardous constituents that cause adverse environmental impacts on surface waters and wetlands. For the Class V injection well disposal option, automated sensors will monitor the injection process to detect potential pipeline leaks or well ruptures that could result in a surface discharge. When monitoring detects potential problems, the applicant will take corrective actions, which include inspections for leaks and spills and rapid response cleanup and remediation to minimize impacts to soils and surface water (Powertech, 2009a). Liquid effluents will not be discharged to running or standing surface waters (Powertech, 2009a). The applicant's NPDES permit requirements for discharges to surface water and SWMP will be in place to ensure that stormwater runoff will not degrade surface water quality. The applicant's emergency response plan will be in place to address and clean up accidental spills and leaks (Powertech, 2009a). The applicant will follow NRC and state regulations concerning the construction of settling and holding ponds (e.g., use of liners, underdrains, and leak detection systems) used to treat and store restoration fluid prior to injection in the Class V well. The applicant is required to follow groundwater restoration activities in compliance with NRC's regulatory requirements (see SEIS Section 2.1.1.1.4). The goal of aquifer restoration is to return groundwater quality in the wellfields consistent with background water quality conditions or to standards consistent with NRC requirements at 10 CFR Part 40, Appendix A, Criterion 5B(5). Because the applicant commits to complying with permitting and regulatory requirements, NRC finds impacts to surface waters and wetlands during the aquifer restoration phase in conjunction with the Class V injection well disposal option at the proposed project site will be SMALL.

4.5.1.1.1.4 Decommissioning Impacts

The central plant, satellite facility, storage facilities, and pipelines of the facility will be removed during the decommissioning phase, in accordance with an NRC-approved decommissioning plan. The wells, including Class V injection wells, will need to be plugged and abandoned. The removal of buildings and infrastructure will have impacts similar to those for the construction phase as described in SEIS Section 4.5.1.1.1.1. The applicant will implement the mitigation measures described in SEIS Section 4.5.1.1.1.1 to control erosion, stormwater runoff, and sedimentation during decommissioning activities. The applicant's NPDES permit requirements will ensure that stormwater runoff will not contaminate surface water. The applicant is committed to implement an emergency response plan to address cleanup of accidental spills and leaks. After removal of surface structures, the applicant will replace topsoil in previously disturbed areas. The applicant will recontour the land surface to restore it to a surface configuration to blend with the natural terrain and will seed disturbed areas in wellfields in accordance with the NRC and SDDENR regulations (Powertech, 2009b). Access roads will be reclaimed and restored in a similar manner.

Well plugging and abandonment and pipeline removal requires temporary soil disturbance that may affect water quality of identified jurisdictional wetlands in the proposed project area. The applicant has committed to seek authorization from USACE and comply with Section 404 permitting requirements before conducting work in jurisdictional wetlands to ensure that wetland habitat and water quality is not impacted (Powertech, 2009a). Because the applicant commits to complying with permitting and regulatory requirements, NRC concludes that impacts to surface waters and wetlands during the decommissioning phase for the Class V injection well disposal option will be SMALL.

4.5.1.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant will dispose of liquid waste by land application (see SEIS Section 2.1.1.2.4.2). The environmental impacts to surface waters and wetlands from the construction, operation, aquifer restoration, and decommissioning associated with the land application liquid waste disposal are discussed in the following sections.

4.5.1.1.2.1 Construction Impacts

For the land application option, a total of 565.7 ha [1,398 ac] of land or 13.2 percent of the proposed permit area will be disturbed by activities associated with construction of facilities, pipelines, wellfields, storage ponds, irrigation areas, and access roads (Powertech, 2010a). This area of land disturbance is larger than for the Class V injection well disposal option {approximately 98 ha [243 ac]} due to the addition of land irrigation areas {426 ha [1,052 ac]} and the need for increased pond capacity for storage during nonirrigation periods {35 ha [136 ac]} (see Table 4.2-1).

All the surface disturbance and associated impacts to surface waters and wetlands discussed in SEIS Section 4.5.1.1.1.1, except for the ground surface disturbance and the impacts to surface waters and wetlands from construction of Class V deep injection wells, will be applicable during the construction phase for the land application disposal option.

Irrigation areas are situated on flat topography along Pass Creek and its tributaries in the Burdock area and along Beaver Creek and its tributaries in the northwest part of the Dewey area (see Figure 4.5-1). The applicant will apply treated liquid effluents to native vegetation or to existing soil after it has been prepared to grow crops such as alfalfa or salt-tolerant wheatgrass (Powertech, 2012c). Significant earthmoving activities will not be conducted to prepare irrigation areas. Runoff from precipitation events or snowmelt on land application areas will be conveyed to catchment areas downgradient of land application areas and allowed to evaporate or infiltrate (Powertech, 2012c). The soil horizon found throughout most of the project area is clayey (see SEIS Section 3.4.2), which will minimize infiltration and enhance evaporation.

Implementation of mitigation measures associated with the applicant's SWMP will control erosion, stormwater runoff, and sedimentation from disturbed areas, as part of the NPDES permit. The applicant's NPDES permit requirements for discharges to surface water will ensure that surface runoff, if any, will not contaminate surface water and wetlands. Additionally, the applicant will implement an emergency spill response plan to address cleanup of accidental spills and leaks. The applicant has committed to seek authorization from USACE and comply with Section 404 permitting requirements before conducting work in jurisdictional wetlands identified in the project area (Powertech, 2009a). The USACE permit ensures that proper filling and dredging techniques are used and proper mitigation measures are defined and implemented and to protect wetland habitat and water quality in affected jurisdictional wetlands. Because minimal land disturbance will occur during preparation of irrigation fields, and the applicant has committed to implement mitigation measures discussed previously and to comply with permitting and regulatory requirements, the NRC staff conclude that impacts to surface waters and wetlands during the construction phase for the land application option will be SMALL.

4.5.1.1.2.2 Operational Impacts

Stormwater runoff from land irrigation areas and their potential discharge into surface waters will be the primary differences in surface water and wetlands impacts between the land application and Class V injection well disposal options. All hydrological factors (hydrological interactions between ore-bearing aquifers, creeks, and abandoned open pit mines) and the resultant assessment of SMALL impacts to surface waters and wetlands due to ISR operations in conjunction with the Class V injection well disposal option (see SEIS Section 4.5.1.1.1.2) also apply to ISR operations in conjunction with the land application option.

Because irrigation fields are located on flat topography (Figure 2.1-11), runoff of treated liquid wastes applied to land irrigation areas is not expected. Additionally, the SDDENR groundwater discharge plan will require land application activities to be conducted so that no ponding and no runoff of effluent (i.e., wastewater solutions) occur. As described in SEIS Section 3.5.1, proposed land application areas are located outside the applicant-modeled 100-year flood inundation boundaries of Beaver Creek and Pass Creek. Potential runoff produced by snowmelt or precipitation in land application areas will be diverted to adjacent catchment areas and allowed to evaporate or infiltrate (Powertech, 2012c). The applicant will grow crops on irrigation fields, which may require adjustments in water application rates to optimize both evaporation and crop production during the irrigation season (Powertech, 2009a, Section 4.5.2). However, the applicant's NPDES permit requirements will ensure that surface runoff at the ISR facilities and irrigation fields from rain events will not contaminate surface water bodies and wetlands. Implementation of mitigation measures will control erosion, runoff, and sedimentation over the land application areas. In addition, the applicant will implement an emergency spill response plan to address cleanup of accidental spills and leaks.

As described in SEIS Section 4.4.1.2.2, licensees must ensure that radioactive constituents in liquid effluents applied to land application areas are within allowable release limits (NRC, 2009a). The applicant proposes to treat liquid wastes applied to land application areas so they meet NRC release limit criteria for radiological contaminants, as referenced in 10 CFR Part 20, Appendix B, Table 2, Column 2 (see Table 7.5-3) (Powertech, 2011). SDDENR also regulates land application of treated wastewater, which requires the applicant to obtain an approved GDP and to comply with applicable state discharge requirements for land application of treated wastewater. Additionally, the GDP will require land application activities to be conducted so that no ponding and no runoff of effluent (i.e., wastewater solutions) occur. Therefore, the NRC staff conclude that treated liquid wastes applied to land application areas will contain contaminant levels below NRC and SDDENR requirements.

Based on the aforementioned hydrological factors and permit requirements, the NRC staff conclude that environmental impacts to surface waters and wetlands from ISR operations in conjunction with the land application option will be SMALL.

4.5.1.1.2.3 Aquifer Restoration Impacts

The aquifer restoration phase of the Dewey-Burdock ISR Project will generate liquid wastes that will be disposed of via land application. As described in the previous section, the applicant proposes to treat liquid wastes applied to land application areas so they meet NRC release limit criteria for radiological contaminants, as referenced in 10 CFR Part 20, Appendix B (Powertech, 2011). SDDENR also regulates land application of treated wastewater, which requires the applicant to obtain an approved GDP and to comply with applicable state discharge requirements for land application of treated wastewater. Liquid effluents will not be discharged into running or standing surface waters (Powertech, 2009a). The applicant's NPDES permit and SWMP will be in place to ensure that runoff from rain events will not contaminate surface waters and wetlands. The applicant's emergency response plan will be in place to address and clean up accidental spills and leaks (Powertech, 2009a). The applicant will follow NRC and state regulations concerning the construction of settling and holding ponds (e.g., use of liners, underdrains, and leak detection systems).

Because treated water applied onto irrigation fields will comply with NRC and state release limits for radioactive and hazardous constituents and because the applicant commits to complying with NPDES permitting and regulatory requirements, the NRC staff find impacts to surface waters and wetlands during the aquifer restoration phase in conjunction with the land application option to be SMALL.

4.5.1.1.2.4 Decommissioning Impacts

All the ground surface disturbance and the resultant impacts to surface waters discussed in SEIS Section 4.5.1.1.1.4 for the Class V injection well disposal option will be applicable for the land application option, except that the latter will not involve plugging and abandonment of Class V injection wells in the decommissioning phase. Under the land application option, production, injection, and monitoring wells will be plugged and abandoned, and the central plant, satellite facility, storage facilities, and associated pipelines will be removed in accordance with an NRC-approved decommissioning plan. The applicant has committed to seek authorization from USACE and comply with Section 404 permitting requirements before conducting work in jurisdictional wetlands to ensure that wetland habitat and water quality are not impacted (Powertech, 2009a). As part of the NPDES permit, the applicant will implement mitigation measures to control erosion, runoff from rain events, and sedimentation to ensure that surface water and wetlands are not contaminated. Additionally, the applicant is committed to implementing an emergency response plan to address cleanup of accidental spills and leaks. After removal of surface structures, the applicant will replace topsoil in previously disturbed areas. Disturbed land surfaces, including irrigation fields used for land application of treated process fluid, will be recontoured to restore the surface configuration to blend with the natural regulations (Powertech, 2009b). Access roads will be reclaimed and restored in a similar manner. Because the applicant commits to complying with permitting and regulatory requirements, NRC concludes that impacts to surface waters and wetlands during the decommissioning phase for the land application disposal option will be SMALL.

4.5.1.1.3 Disposal Via Combination of Class V Injection and Land Application

If the applicant obtains the permit for Class V injection from EPA, but the capacity of the deep disposal wells is insufficient to dispose of all liquid effluents generated at the Dewey-Burdock ISR project, the applicant will dispose of liquid waste by a combination of Class V injection wells and land application (SEIS Section 2.1.1.1.2.4.3). In this case, land application facilities and infrastructures will be constructed, operated, and restored, and decommissioned as needed, based on the required capacity of Class V injection wells and produced volume of liquid effluents (Powertech, 2011).

If the capacity of Class V injection wells is sufficient to dispose of all liquid effluents, land application sites, facilities, and infrastructures for irrigation will be avoided. In this case, potential environmental impacts to surface waters and wetlands due to erosion and surface runoff of rainwater over land application sites will be eliminated. Therefore, the resultant environmental impacts to surface water and wetlands for the Class V injection well disposal option will be smaller than for the land application disposal option. Furthermore, only a portion of land application facilities and infrastructure (e.g., irrigation areas and storage ponds) will be constructed, operated, and decommissioned for the combined Class V injection well and land application option. Therefore, potential environmental impacts to surface waters and wetlands for the combined disposal option will be less than for the land application option alone.

Thus, NRC staff conclude that the environmental impacts of the combined Class V injection well and land application option for each phase of the proposed project will be bounded by the significance of environmental impacts of the Class V injection well option and the land application option as summarized in Table 4.5-1.

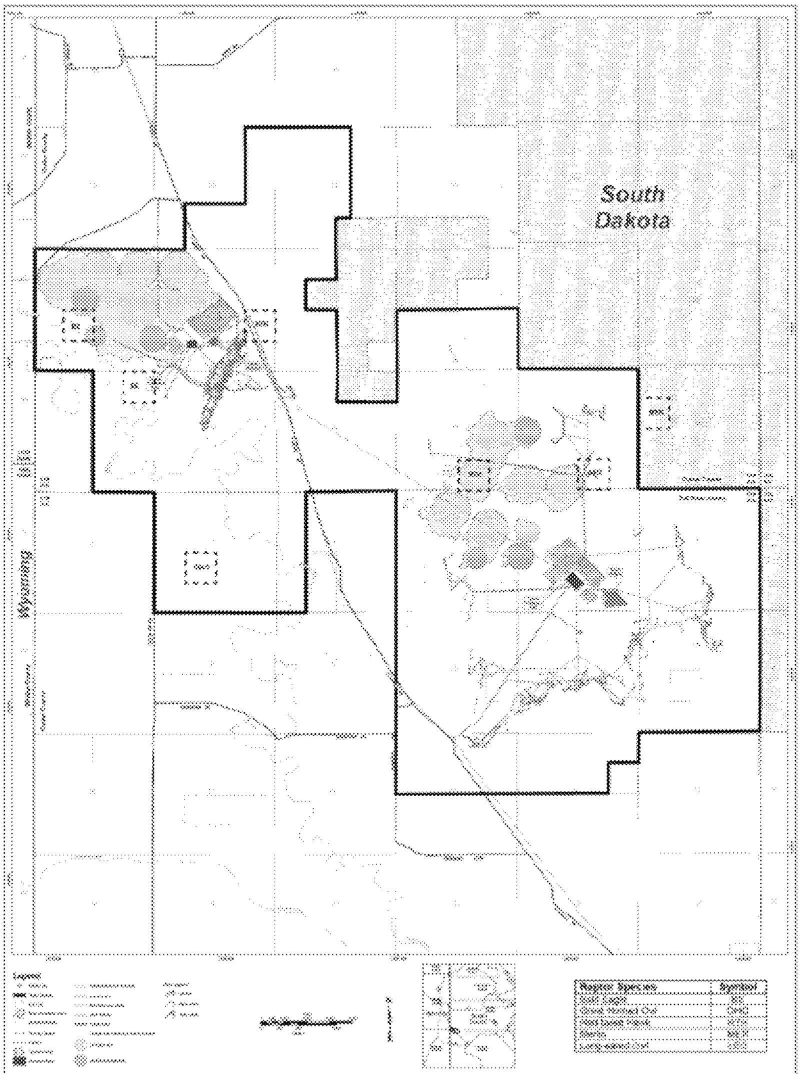

Figure 4.6-4. Map of Raptor Nest Locations in the Dewey-Burdock Project Area and Planned Facilities for the Land Application Option
Source: Powertech, 2012a

5.6.4 Surface Water

5.6.4.1 Potential Surface Water Impacts

Potential surface water impacts include increased sediment load due to surface disturbance, very limited stream channel disturbance, potential encroachment on wetlands, and potential water quality impacts from leaks or spills. Each of these is described below.

5.6.4.1.1 Potential Sedimentation

Construction activities within the well fields, along the pipeline corridors and roads, and at the CPP and Satellite Facility have the potential to increase the sediment yield of the disturbed areas. The potential impacts will be minimal due to the relatively small size of the disturbance areas relative to the watershed areas and due to the implementation of the sediment control plan described in Section 5.3.9 and the mitigation measures described in Section 5.5.4.2.

5.6.4.1.2 Potential Impacts to Stream Channels and Riparian Areas

As described in Section 5.3.9, Powertech (USA) has evaluated flood inundation boundaries and will construct facilities outside of these boundaries to avoid potential impacts to facilities from flooding and potential impacts to the stream channels. Some facilities must be located within stream channels, such as pipeline corridors and access roads. These will cross the stream channels perpendicular to the flow direction to minimize disturbance. Primary and secondary access road stream channel crossings will include culverts as described in Section 5.3.8.

Ephemeral stream channels also will be disturbed temporarily at the upstream and downstream ends of the diversion channels described in Section 5.3.9.1, which describes the erosion protection measures that will be used for diversion channels.

Facilities potentially constructed in the cottonwood gallery riparian zone along Pass Creek include a limited number of access roads, pipelines and utility corridors. Following is a discussion of potential impacts associated with these facilities.

To a limited extent, access roads will be constructed within the cottonwood gallery riparian zone. Most of these roads will be light-use roads (tertiary access roads), which are described in Section 5.3.8 as essentially non-constructed, two-track trails. To the extent possible, existing two-track roads will be used. The route for any new light-use roads that will be required within the cottonwood gallery riparian zone will be selected to minimize impacts to the riparian zone and to minimize erosion.

One secondary access road is planned through the cottonwood gallery riparian zone. This road is depicted on Plate 5.3-5 (Sheet 2) in the NWNW Section 3, T7S, R1E. It is an existing road near a dwelling that crosses Pass Creek and the riparian zone using a well-established route. Since the proposed secondary access road will be an upgrade to an existing road, potential impacts to Pass Creek will be minimized. Powertech (USA) intends to continue to use the existing low-water crossing and not install a bridge or culvert at this location. Erosion control measures described in Section 5.3.9 will be used for any disturbance areas that could contribute sediment to Pass Creek.

The plant-to-plant pipeline(s), if constructed, will cross the riparian zone near the existing low-water crossing. In addition, a utility corridor consisting of an overhead power line and buried pipeline is planned across the Pass Creek riparian zone in the SESW Section 34, T6S, R1E (refer to Plate 5.3-1, Sheet 2). The pipeline and utility routes through the riparian zone will be selected to minimize potential impacts. The Pass Creek pipeline crossings will be trenched or bored. Mitigation measures to minimize impacts will include use of sediment control measures, avoiding construction during early spring while runoff from snowmelt is occurring, and complying with applicable U.S. Army Corps of Engineers permitting requirements.

Disturbance to the cottonwood gallery riparian zone will be relatively small due to the limited number of utility crossings and use of existing roads. Special care will be taken in this area to control sediment. During construction, silt fences, straw beds, and other sediment control measures will be used to minimize any potential water quality impacts.

5.6.4.1.3 Potential Impacts to Wetlands

The majority of the potential wetlands in the permit area occur along Beaver Creek and Pass Creek. Potential well field areas all occur away from Beaver Creek and Pass Creek, and potential wetlands along Beaver Creek and Pass Creek will not be impacted by construction activities. The remaining potential wetlands are dispersed throughout the permit area as small depressions and ponds, historical mine pits, and an area around a flowing artesian well. The wetlands within the historical mine pits are not planned to be disturbed. There may be some encroachment impacts to small, depressional wetland areas.

Construction, operation, or reclamation activities, which cause disturbance or impacts to jurisdictional wetlands, will be performed in accordance with appropriate Nationwide Permits issued by the U.S. Army Corps of Engineers, if applicable. These may include Nationwide Permit (NWP) 44 non-coal mining activities, which requires Pre-construction Notification (PCN) for all activities, NWP 12 utility line activities, which requires PCN for an area where a Section 10 permit is required, discharges that result in the loss of >0.1 acre, and NWP 14 linear transportation projects, which requires a PCN for 0.5 acre in non-tidal waters. NWP 44 has an acreage limit of 0.5 acre for Waters of the U.S. (WoUS). NWP 12 and 14 also have 0.5-acre disturbance limits. Impacts to Other Waters of the U.S. (OWUS) are not considered under the acreage limit. Appendix 3.8-B contains the USACE jurisdictional determination for the permit area.

5.6.4.1.4 Potential Surface Water Quality Impacts from Leaks or Spills

Potential surface water quality impacts from leaks or spills are addressed in Section 5.6.5.1. Mitigation measures are described in Section 5.6.5.2.

5.6.4.2 Mitigation of Potential Surface Water Impacts

The following procedures will be used to minimize the potential impacts to surface waters.

• Minimize disturbance of surface areas and vegetation which, in turn, will minimize erosion and runoff rates.

• Minimize physical changes to drainage channels unless changes are made to upgrade drainage.

• Use erosion and runoff control features such as proper placement of pipe, grading to direct runoff away from water bodies, and use of riprap (broken rock and/or concrete) at these intersections to make bridges or culverts more effective, if necessary.

• Use sediment trapping devices such as hay or straw bales, fabric fences, and devices to control water flow and discharges to trap sediments moved by runoff.

• Maintain natural contours as much as possible, stabilizing slopes and avoiding unnecessary off-road travel with vehicles; maintaining natural contours as much as possible, stabilizing slopes and avoiding unnecessary off-road travel with vehicles.

• The land application of treated wastewater will occur at agronomic rates to avoid irrigation runoff into surface water; catchment areas also will prevent land application water from entering surface water.

• Prepare and implement a Stormwater Pollution Prevention Plan that is consistent with state and federal standards for construction and operation activities.

• Facilities will be constructed outside of flood inundation areas to the extent practicable.

• Best management practices will be utilized during ISR operations.

Powertech (USA) will comply with South Dakota surface water quality standards for surface water sites during and after ISR operations and during reclamation. Operational surface water monitoring will occur at 10 stream sampling sites listed in Table 5.5-3. Four of these sites are on stream segments with designated beneficial uses (Beaver Creek and the Cheyenne River). Section 3.5.4.1.1 describes how the sampled segments of Beaver Creek and the Cheyenne River have beneficial uses for warmwater semipermanent fish life propagation and limited-contact recreation. Section 3.5.4.1.1 describes how baseline samples collected from Beaver Creek met the ARSD 74:51:01:48 criteria for warmwater semipermanent fish life propagation waters except for some measurements of total suspended solids (TSS). Similarly, Cheyenne River baseline samples met the criteria except for some TSS measurements and one dissolved oxygen measurement.

Routine operational monitoring of surface water sites will be used to demonstrate compliance with the antidegradation policy for surface waters in ARSD 74:51:01:34, which requires existing beneficial uses to be maintained and protected. The mitigation measures described above will ensure that the Dewey-Burdock Project will not cause significant changes in surface water quality. To verify the effectiveness of mitigation measures, Powertech (USA) will analyze surface water samples for the parameter list in Table 5.5-4.

5.6.5 Spills and Leaks

5.6.5.1 Potential Impacts from Spills and Leaks

Potential impacts from spills and leaks include potential impacts to soil, surface water, and groundwater resulting from a spill or leak in the well fields, processing facilities, transportation vehicles, or ponds. Each of these is described below.

5.6.5.1.1 Well Fields and Pipelines

Well field features such as header houses, well heads or pipelines could contribute to pollution in the unlikely event of a release of ISR solution due to pipeline or well failure. A spill or leak in these areas could potentially impacts soils, surface water and groundwater. Potential impacts will be minimized by routine MIT of all injection, production and monitor wells and hydrostatic leak testing of all pipelines during construction; implementing an instrumentation and control system to monitor pressure and flow and immediately detect and correct an anomalous condition; and implementing a spill response and cleanup program in accordance with NRC license requirements and DENR permit conditions.

5.6.5.1.2 CPP and Satellite Facility

The CPP will serve as the hub for production operations at the project; therefore, the CPP will likely have the greatest potential for spills or accidents potentially resulting in the release of pollutants. Potential releases also could occur from the Satellite Facility. Potential releases could result from a tank or process vessel failure, pipe rupture, or transportation incident.

Failure of a process vessel, tank, or pipeline within the CPP or Satellite Facility will be contained within the building via concrete containment curbs and directed into a sump (equipped with a level alarm) that will transport the solution the appropriate tank or disposal system. The concrete containment curb for the CPP has been designed to contain the entire contents of the two largest liquid-containing vessels (yellowcake thickeners) in the extremely unlikely event that both vessels should fail simultaneously and spill their entire contents. The sumps will provide additional temporary containment capacity such that the total containment capacity of curbs and sumps will be greater than 200% of the largest liquid-containing tank or vessel in the CPP. The Satellite Facility similarly will have a curb and sump system that together will provide approximately 350% of the volume of the largest liquid-containing vessel or tank (utility water tank).

The design of the CPP and Satellite Facility will be such that any spill will be contained within the respective building, regardless of sump pump operation. In the event of a total electrical failure, such that no pumps would be operational, a spill due to a vessel failure would be contained within the building in which the vessel failure occurred.

Chemical storage areas adjacent to the CPP will be provided with secondary containment as discussed in Section 5.3.1.

5.6.5.1.3 Transportation Vehicles

An accident involving transportation vehicles within or to and from the permit area could potentially release pollutants to the environment. Transportation vehicles will include, but are not limited to: vehicles delivering bulk chemical products, transport of uranium-loaded resin from the Satellite Facility or another satellite facility to the CPP, transport of solid 11e.(2) byproduct material from the project site to an approved disposal site, or transport of dried yellowcake product from the CPP.

Chemicals and products delivered to or transported from the permit area will be transported in accordance with all applicable federal and state regulations. As part of Powertech (USA)'s Environmental Management Program, emergency response procedures will be developed and implemented to ensure a rapid response to any transportation incidents. All personnel will be appropriately trained in emergency response procedures to facilitate proper response from Powertech (USA) employees in transportation incidents.

Potential impacts would differ according to material type, quantity and concentration. Transportation risks for yellowcake shipments, uranium-loaded resin shipments, process chemicals/fuel, and 11e.(2) byproduct material are described in the NRC license application. These are briefly summarized below.

Yellowcake Shipments

A specialized, appropriately licensed transportation company will transport the yellowcake to a conversion facility. Powertech (USA) will develop an Emergency Preparedness Program that will be implemented should a transportation accident occur. The primary potential impact associated with an accident involving the spill of yellowcake would be potential impacts to soil in the immediate spill area. The potential impacts will be minimized by implementing the Emergency Preparedness Program and salvaging affected soils.

Uranium-loaded Resin Shipments

Resin shipments typically will occur in bulk transport trailers. Resin shipments potentially will include uranium-loaded resin shipments between the Satellite Facility and CPP or between another satellite facility outside of the permit area to the CPP. They also would include barren or eluted resin shipments from the CPP to a satellite facility. A transportation accident involving uranium-loaded resin would have a lower risk than the relatively low risk from an accident involving yellowcake due to the much lower concentration of uranium in the resin and the chemical bond between the uranium and IX resin. The primary potential impact associated with an accident involving the spill of resin would be potential impacts to soil in the immediate spill area. The potential impacts will be minimized by salvaging affected soils.

Process Chemicals and Fuel

A number of shipments of chemicals and fuel will be made each week throughout operations. Process chemicals delivered to the permit area will include carbon dioxide, oxygen, salt, soda ash, barium chloride, hydrogen peroxide, sulfuric acid, hydrochloric acid, and caustic soda. All applicable DOT hazardous materials shipping regulations and requirements will be followed during shipment of process chemicals and fuel to minimize the potential for transportation accidents. Powertech (USA) also will develop standard operating procedures for unloading process chemicals and fuel within the permit area to minimize the potential for spills.

11e.(2) Byproduct Material

All solid 11e.(2) byproduct material generated in the permit area will be transported to an appropriately licensed disposal facility. Most of the solid 11e.(2) byproduct material shipping will occur during site reclamation and decommissioning. The potential risk of a transportation accident is low, since solid 11e.(2) byproduct material is generally less radioactive than yellowcake and most of the waste will be in a solid form that is easy to contain. All applicable DOT regulations and requirements will be followed during shipment to minimize the potential for a spill resulting from a transportation accident. The primary potential impact associated with an accident involving the spill of solid 11e.(2) byproduct material would be potential impacts to soil in the immediate spill area. The potential impacts will be minimized by salvaging affected soils.

5.6.5.2 Mitigation of Potential Impacts from Spills and Leaks

The following is a list of mitigation measures for potential impacts from spills and leaks.

- Conduct routine mechanical integrity testing of all injection, production and monitor wells.
- Perform leak testing on all pipelines and aboveground piping systems.
- Equip well field header houses with wet alarms for early detection of leaks.
- Bury well field pipelines for freeze protection and protection from vehicles.
- Implement engineering and administrative controls at the Central Processing Plant to prevent both surface and subsurface releases to the environment, and to mitigate the effects should an accident occur.
- Train employees in the handling, storage, distribution, and use of hazardous materials.
- Provide rapid response cleanup and remediation capability, techniques, procedures, and training for potential spills.
- Develop written spill reporting procedures, including the procedures to report potential spills of reagents, fuel and other chemicals to the State of South Dakota and the personnel responsible for reporting spills.
- Design and construct ponds with lining and leak detection systems.
- Perform routine inspection of pond leak detection systems to rapidly detect a potential leak from the primary liner.
- Implement standard operating procedures to take a pond out of use in the event of a leak and transfer its contents to another pond with the same lining system.
- Conduct fueling operations and storage of hazardous materials and chemicals in bermed/curbed areas and in a manner that minimizes potential impacts to surface water.
- Curb relevant facilities and structures at the CPP and Satellite Facility to minimize or eliminate escape of process fluids during spills.
- Perform all shipments of yellowcake, uranium-loaded resin, process chemicals/fuel, and 11e.(2) byproduct material in accordance with DOT regulations.
- Promptly salvage soils from any spill areas to avoid potential impacts to surface or groundwater.

5.6.6 Potential Accidents

The accident scenarios with potential to occur at the Dewey-Burdock Project are those typical of other ISR facilities. These scenarios have been evaluated in NUREG/CR-6733, A Baseline Risk-Informed, Performance-Based Approach for In Situ Leach Uranium Extraction Licensees (NRC, 2001), and are discussed below. Three primary engineering controls will include 1) downflow, pressurized IX columns, 2) building ventilation, and 3) use of a modern vacuum yellowcake dryer. Also included in the engineering controls will be alarms to indicate suboptimal operating conditions of the effluent control systems and concrete curbs and sumps to contain any process spills. Administrative controls such as training for emergency scenarios will be in place to provide appropriate worker protection in the event that the effluent control systems fail under an emergency situation. In brief, the engineering controls coupled with appropriate administrative controls will mitigate any potential health and safety impacts of system failures at the facility.

A series of potential accident scenarios which could occur at an ISR facility were evaluated in NUREG/CR-6733 and included the following:

- Yellowcake thickener failure and spill
- Radon release in enclosed process areas
- Pregnant lixiviant and loaded resin spills
- Yellowcake dryer hazard analysis

The estimated radiological consequence resulting from these accidents ranged from no significant radiological exposures, in the case of the thickener failure and pregnant lixiviant/loaded resin spill, to a significant radiological exposure which could result in doses to workers exceeding those allowed in 10 CFR Part 20. Due to the short-term nature of the above scenarios and assuming spills and releases are mitigated promptly, no scenario was expected to result in a significant radiological dose to members of the public.

During an accident, administrative controls will be in place such as standard operating procedures for spill response and cleanup, programs for radiation and occupational monitoring, and training for workers in radiological health and emergency response. Administrative controls coupled with proper use of PPE such as respirators are the best tools to reduce worker doses and will be provided.

Other approaches to mitigate system failures that may result in exceeding exposure limits include but are not necessarily limited to the following:

1) A team of responders, trained for radiation health and emergency response, will be available. Specific training will include: response monitoring, PPE use and response to fires, large lixiviant spills or IX system failure.

2) Powertech (USA) will train local emergency response personnel in the potential hazards present within the permit area.

3) A yellowcake thickener failure and spill would result in the immediate evacuation of normal operating personnel within the spill area and cleanup of the saturated product prior to drying. Employees performing the cleanup would utilize the appropriate PPE to minimize exposure to any product that may dry during cleanup. Yellowcake residue that may remain within the thickener area would be washed into a sump, thus mitigating the potential for exposure to employees.

4) Unplanned radon release into an enclosed area would result in manual shutdown of the release point (if automated shutoff system failed) and promotion of ventilation within the area manually (if

automated ventilation system failed). Employees performing manual shutdown within the area of the release would utilize the appropriate PPE (such as atmosphere-supplying respirators designed to protect against gases) to minimize exposure to radon and radon decay products. Radon samples would be taken and if above normal working levels, normal operating workers would be evacuated and only return to normal duties within the release area upon re-establishment of normal working levels.

5) A pregnant lixiviant spill would be mitigated in a manner consistent with the location and degree of spill. Response personnel would utilize the appropriate PPE to protect against radon and radon decay products exposure as discussed above and cleanup would result.

6) A yellowcake dryer upset response would be dictated by the severity of the upset. Mitigation response may include a combination of additional site-specific response actions such as:

• Workers, including the spill response team, will have access to respiratory equipment in the yellowcake dryer area.

• All practicable measures will be taken to control emissions at the source. The operator will reduce exposure to airborne effluent releases by implementing emission controls (such as wetting) and institutional controls (such as extending the area of upset so as to exclude any personnel not responding to the upset).

• Siting of the CPP near the center of the proposed license area will serve to protect against off-site exposures in the event of a yellowcake dryer upset.

• Individual dose standards will be strictly implemented to assure exposures are limited and reduced to the maximum extent reasonably achievable and to limit contamination to the designated upset area.

• All drying and packaging operations will terminate until cleanup is complete, the area has been cleared for potential exposure, and equipment has been restored to proper operating conditions and efficiencies.

• Cessations, corrective actions and restarts will be reported to NRC within 10 days of the upset or off-normal performance.

5.6.7 Potential Natural Disaster Risk

NRC guidance in NUREG/CR-6733 evaluates potential risks associated with ISR facilities for the release of radioactive materials or hazardous chemicals due to the effects of an earthquake or tornado strike. The NRC determined that in the event of a tornado strike, chemical storage tanks could fail, resulting in the release of chemicals. This risk will be minimized by implementing the secondary containment measures for chemical storage described in Section 5.3.1. NUREG/CR-6733 concluded that the risk of a tornado strike on an ISR facility is very low and that no design or operational changes are necessary to mitigate the potential risks, but that it is important to locate chemical storage tanks far enough from each other to prevent contact of reactive chemicals in the event of an accident. Chemical storage tanks will be separated at the Dewey-Burdock Project as described in Section 5.3.1.

Considering the relative remoteness of the permit area, the potential consequences of a tornado strike would be considerably less than if the facilities were in a more populated area. Nevertheless, there are risks to workers that will be addressed. Powertech (USA) will prepare and have available onsite for regulatory inspection an Emergency Response Plan that will contain emergency procedures to be followed in the event of severe weather or other emergencies. Included in the plan will be procedures for notification of personnel, evacuation procedures, damage inspection and reporting. It also will address cleanup and mitigation of spills that may result from severe weather. In advance of preparing the Emergency Response Plan, Powertech (USA) offers the following discussion on these issues.

Initially, Powertech (USA) will provide adequate training to its employees visitors regarding communication systems used at the facilities. In the event of a report of a tornado sighting in the vicinity of the facility, the Radiation Safety Officer (RSO), Radiation Safety Technician (RST) and/or Safety Engineer will ensure that the proper alarm (preset signal) has been sounded at both the Burdock and Dewey facilities. Additionally, all supervisors will be personally contacted via phone or radio and advised of the emergency. The supervisors and radiation safety staff will direct the evacuation of employees to one or more previously-specified nearby locations. Once it is safe to access the facilities, supervisory staff and radiation safety staff will begin the process of assessing potential damage to the facilities, including header houses and well heads. This process will include radiological surveys and assessment of potential non-radiological hazards as well. NRC, DENR, BLM and other regulatory agencies as appropriate will be notified and advised of the damage, if any was observed. After consultation with the regulatory agencies the cleanup and mitigation efforts will commence.

NRC determined that the potential radiological consequences of materials released and dispersed due to earthquake damage at an ISR facility are no greater than for a tornado strike. NUREG-0706 (NRC, 1980b) determined that mitigation of earthquake damage could be attained following adequate design criteria. NUREG/CR-6733 concluded that risk from earthquakes is very low at uranium ISR facilities and that no design or operational changes are required to mitigate the risk, but that it is important to locate chemical storage tanks far enough from each other to prevent contact of reactive chemicals in the event of an accident.

All buildings, structures, foundations, and equipment will be designed in accordance with recommendations in the latest versions of the International Building Code and ASCE-7 published by the American Society of Civil Engineers. Maps published in ASCE-7, and the latest version of the USGS Earthquake Ground Motion Tool, along with information regarding soil characteristics provided by the project professional geotechnical engineer, will be used to determine seismic loadings and design requirements.

5.6.8 Potential Fire and Explosion Risk

Accident Consequences – Fires and Explosions

An explosion, although unlikely, could result from: a prematurely sealed drum of yellowcake, in a dryer, from the use of propane in the thermal fluid heater or space heaters, or from the mixing of oxygen gas with combustible materials. Of these, an explosion from the drum of yellowcake has the greatest potential to impact radiological safety of the workers. An explosion in a sealed drum would be contained within the dryer room. Powertech (USA) will develop a standard operating procedure for measuring the temperature in yellowcake drums prior to drum sealing.

According to NRC, multiple hearth dryers pose a greater hazard than the vacuum dryers that will be used by Powertech (USA) (NUREG-1910, NRC, 2009). Multiple hearth dryers operate at higher temperatures and may be fed directly with gas. The vacuum dryers to be used at the Dewey-Burdock Project operate at lower temperatures and are not fed directly by gas. They therefore pose less of a hazard for explosion. In the unlikely event of an unmitigated explosion accident of a yellowcake dryer, doses to the workers could have a moderate impact depending on the type of accident, but exposure to the general public would result in a dose below the 10 CFR Part 20 public dose limit, resulting in only a small impact to the public (NUREG-1910).

Preventative and Mitigation Measures – Fires and Explosions

As noted in Section 5.3.1, the design criteria for chemical storage and feeding systems includes applicable sections of the International Building Code, International Fire Code, OSHA regulations, RCRA regulations, and Homeland Security regulations. Propane-fired heating devices will be installed to meet applicable NFPA/FM safety standards. Additional measures for preventing fires and explosions include:

• The oxygen tanks will be located a safe distance from the CPP and other storage tanks and will be designed to meet industry standards of NFPA-50.

• Cleaning of equipment for oxygen storage and conveyance systems will follow the standards specified in CGA G-4.1.

• Powertech (USA) will develop emergency response procedures for oxygen accidents. All employees who may be exposed to hazards associated with oxygen will be properly trained with regard to the hazards, accident prevention and mitigation, and emergency response procedures.

• Header houses will be equipped with fans to provide continuous ventilation in order to prevent buildup of oxygen.

• The oxygen lines to each header house will be equipped with automatic low pressure shut-off valves to minimize the delivery of oxygen through a broken pipe or a valve stuck in the open position, which could potentially supply oxygen to a fire.

• Procedures will be in place for confined space work or hot work for monitoring of oxygen build-up prior to start of work.

• Fire extinguishers will be placed at accessible locations in all buildings and vehicles for quick response and training will be provided for appropriate personnel in use of fire extinguishers.

• Powertech (USA) personnel and local emergency responders will receive training for responding to a fire or explosion.

• The CPP and Satellite Facility are designed to contain and reduce the exposures to individuals in the event of an accident. Emergency response procedures would be implemented and employees would be directed as to what actions to perform in the event of an accident. For instance, a respiratory protection program will be in place and will be executed as necessary for worker protection during accident assessment and cleanup phases. In addition to the above mentioned protections other safeguards and mitigatory protocols are always in place during operation of a CPP facility. For example, a bioassay program for worker safety and contamination control programs involving personnel survey, clothing survey and equipment survey before release to unrestricted areas are common practices workers are subject to on a regular basis. These types of protocols are also utilized to assess if an accidental exposure took place during the course of an unintentional incident.

Preventative and Mitigating Measures – Wildfire

In order to protect facilities from wildfires, all facility buildings will be located within an area that is maintained in a vegetation-free state by the use of a crushed aggregate or asphalt surface and by appropriate weed-control measures. The creation of this buffer zone is expected to prevent fire from damaging equipment that could lead to a chemical accident by acting as a firebreak.

Within the well fields, vegetation will be controlled around each header house and around each well head cover to reduce the amount of combustible material adjacent to these structures. In the event of an approaching wildfire, operators will be trained to shut down well field operations and, if necessary, to evacuate facilities until the danger to personnel has passed. Damage, if any, will be assessed and remediated prior to re-starting operations.

Powertech (USA) will maintain firefighting equipment on site and will provide training for local emergency response personnel in the specific hazards present in the permit area.

The emergency response plan will include descriptions of the following provisions of 29 CFR Part 1910:

- Notification and evacuation procedures
- Personal protective equipment
- General firefighting safety rules
- Reporting procedures
- Electrical and gas emergencies

5.6.9 Potential Radiological Impacts and Effluent Control System

5.6.9.1 Potential Radiological Impacts

In accordance with NRC guidance, Powertech (USA) modeled the potential radiological impacts on human and environmental receptors (e.g., air and soil) using site-specific radionuclide release estimates, meteorological and population data, and other parameters. The estimated radiological impacts resulting from routine site activities then were compared to applicable public dose limits as well as naturally occurring background levels. The complete analysis is available in the NRC license application. Following is a brief summary of the results.

The primary radioactive airborne effluent will be radon-222 gas. Radon-222 is dissolved in the pregnant lixiviant that comes from the well field into the facility for separation of uranium. At the locations where the lixiviant solution is initially exposed to atmospheric pressure and ambient temperatures, radon gas will be evolved. The locations where this will occur (IX vessels and shaker screens in the CPP and IX vessels in the Satellite Facility) will be provided with dedicated local exhaust, which will be vented outside of the buildings. Small amounts of radon-222 also may be released from the well field, solution spills, filter changes, RO system operation during groundwater restoration, DDW surge tanks, land application areas, and maintenance activities.

The potential radiological impact analysis considered all potential exposure pathways from all potential sources in the permit area. Atmospheric radon gas is expected to be the predominant pathway for impacts on human and environmental media. Impacts of radon-222 releases can be expected in all quadrants surrounding the site, the magnitude of which is driven predominantly by wind direction and atmospheric stability. As a noble gas, radon-222 itself has very little radiological impact on human health or the environment. Radon-222 has a relatively short half-life (3.2 days) and its decay products are short lived, alpha emitting, nongaseous radionuclides. These decay products have the potential for radiological impacts to human health and the environment. Potential exposure pathways include ingestion, inhalation, direct exposure, and adsorption. All exposure pathways, with the possible exception of absorption, can be important depending on the environmental media impacted. All of the pathways related to emissions of radionuclides are evaluated by modeling, including potential exposure from air, water, soil, flora and fauna.

The potential radiological impact analysis concludes that the primary sources of radon-222 releases will be production well fields, the CPP and Satellite Facility. Lesser releases are anticipated to occur from DDWs, land application areas, and other minor activities. Modeling was used to simulate potential impacts to receptors including the nearest residence. The modeling shows that the maximum annual total effective dose equivalent (TEDE) for an adult at the nearest residence will be approximately 2% of the 10 CFR Part 20 public dose limit of 100 mrem/year. If land application is not used, the calculated TEDE is less than 2% of the public dose limit.

Powertech (USA) also evaluated the potential public and occupational doses for public exposure to radon decay products. Conservatively assuming that a worker not associated with the Dewey-Burdock Project (e.g., a rancher) is in the permit area for 2,000 hours per year, the expected annual occupational dose would be less than 2% of the of the public dose limit.

Modeled impacts to soils in the general permit area resulting from deposition of radium-226 indicate that the radium-226 concentration after ISR operations will be within the range of normal background variability observed during baseline characterization. In the land application areas, modeled impacts to soils show that the radiological impacts of the land application process will be minimal and meet the criteria for license termination for unrestricted use in 10 CFR § 20.1402.

5.6.9.2 Effluent Control System

Potential radiological impacts to human and environmental receptors will be mitigated through implementation of an effluent control system satisfying NRC license requirements and using best available control technology. The effluent control system is described in detail in the NRC license application and will include controls for radon and radon decay products as well as controls for radionuclide particulates.

Radon

Potential impacts from radon will be controlled through use of pressurized, downflow IX vessels and ventilation systems. The IX vessels normally will operate as sealed, pressurized vessels, so that radon releases from the IX vessels only will occur during resin transfer operations. Dedicated local exhaust at the IX vessels and shaker screens will be directed to a manifold that is exhausted to the atmosphere outside the building via an induced draft fan. The primary release point will be located away from building intakes to prevent introducing exhausted radon back into the facility. Exhausting radon-222 gas to the atmosphere outside the plant minimizes opportunity for in-growth of radon particulate decay products in occupied work areas and therefore minimizes employee airborne exposure.

The general HVAC systems in the CPP and Satellite Facility will reduce employee exposure further by removing radon from plant air. The general HVAC systems will be exhausted through separate vents. These systems will be connected via ductwork and manifolds to the process vessels. Airflow through any openings in the vessels will be from the process areas into the vessels and then into the ventilation systems, maintaining negative flow into the vessels and controlling any releases. Tank ventilation of this type has been utilized successfully at other ISR facilities and proven to be an effective method for minimizing employee exposure. Redundant exhaust fans will direct collected gases to discharge piping that will exhaust to the outside atmosphere. Fan redundancy will minimize employee exposure should any single fan fail.

The general building ventilation systems will be designed to maintain air flow from the process areas with the least potential for airborne releases to areas with the most potential for airborne releases and then exhaust to outside areas. Ventilation systems will exhaust outside the buildings and draw in fresh air. During favorable weather conditions, open doorways and convection vents in the roofs will provide supplemental work area ventilation.

The CPP will be located near the center of the permit area, and the radon exhaust point will be located on or near the CPP roof. Based on use of modern ISR equipment, engineering controls such as building ventilation, and routine sampling and monitoring described below, radon effluent and worker exposure to radon decay products will be maintained at levels that are as low as reasonably achievable (ALARA).

An operational monitoring program will be utilized to measure radon-222 that may result in the atmosphere outside the buildings and other specified locations within the permit area. This will be done in accordance with NRC license conditions. Potential release points as well as general air in the plant will be sampled routinely for radon decay products to assure that concentration levels of radon and decay products are maintained ALARA. Results of monitoring obtained during initial plant operation will be used to adjust monitoring programs (location, frequency, etc.) and upgrade ventilation and/or other effluent control equipment as may be necessary.

Radionuclide Particulates

Potential radiological air particulate effluents will be generated primarily from dried uranium concentrate in the yellowcake drying and processing areas. The yellowcake drying and packaging area will be serviced by a dedicated ventilation system. By design, vacuum dryers do not discharge uranium. The vacuum drying system is proven technology, which is being used successfully at several facilities where uranium oxide is being produced, including ISR facilities. The off-gas treatment system of the vacuum dryers will include a baghouse, condenser, vacuum pump, and packaging hood. The potential radionuclide particulate releases from the drying process and associated off-gas treatment system are discussed below.

The yellowcake will be dried at approximately 250°F in the rotary vacuum drying process. The off-gases generated during the drying cycle will be filtered through a baghouse, which will be located on the top of the dryer, to remove particles down to approximately 1 micron in size. The gases then will be cooled and scrubbed in a surface condenser to further remove the smaller size fraction particulates and the water vapor during the drying process. Two rotary vacuum dryers will be located in a separate building attached to the CPP. This attached building will contain the dryers, the baghouses on the dryers, and a condenser scrubber and vacuum pump system for each dryer.

The vacuum dryers will be steel vessels heated externally and fitted with rotating plows to stir the yellowcake. Each drying chamber will have a top port for loading the wet yellowcake and a bottom port for unloading the dry powder. A third port will be provided for venting through the baghouse during the drying procedure. The baghouse and vapor filtration unit will be mounted directly above the drying chamber so that any dry solids collected on the bag filter surfaces can be batch discharged back to the drying chamber. The baghouse will be heated to prevent condensation of water vapor during the drying cycle. It will be kept under negative pressure by the vacuum system.

The condenser will be located downstream of the baghouse and will be water cooled. It will be used to remove the water vapor from the non-condensable gases emanating from the drying chamber. The gases will be moved through the condenser by the vacuum system. Dust passing through the bag filters will be wetted and entrained in the condensing moisture within this unit. The vacuum pump will be rotary water sealed, providing negative pressure on the entire system during the drying cycle. It also will be used to provide negative pressure during transfer of the dry powder from the drying chamber to 55-gallon steel drums. The water seal of the rotary vacuum pump will capture entrained particulate matter remaining in the gas streams.

The packaging system will be operated on a batch basis. When the yellowcake is dried sufficiently, it will be discharged from the drying chamber through a bottom port into 55-gallon steel drums. A level gauge, a weigh scale, or other suitable device will be used to determine when a drum is full. Particulate capture will be provided by a sealed hood that fits on the top of the drum, which will be vented through a sock filter to the condenser and the vacuum pump system when the powder is being transferred.

There will be three discharge locations associated with the yellowcake drying and packaging system. These include: i) the yellowcake discharge valve located directly below the dryer, through which drums are filled with yellowcake, ii) the condensed water vapor that is removed from the condenser and recycled to the yellowcake thickener, and iii) very small amounts of air that are drawn through the vacuum pump and are exhausted into the dryer room of the CPP. The system of treating gases emanating from the dryer chamber with baghouse filters and water condenser is designed to capture virtually all particles from the vapor stream leaving the dryer (NUREG-1910, NRC, 2009). Furthermore, NUREG-1569 (NRC, 2003) states, "When a vacuum dryer is used for yellowcake, then dust emissions from drying may also be assumed to be negligible."

The emission control system will be instrumented sufficiently to operate automatically and to shut itself down for malfunctions such as heating or vacuum system failures. The system will alarm if there is an indication that the emission control system is not performing within operating specifications. If the system is alarmed due to the emission control system, the operator will follow standard operating procedures to recover from the alarm condition, and the dryer will not be unloaded or reloaded until the emission control system is returned to normal service.

To ensure that the emission control system is performing within specified operating conditions, instrumentation will be installed that signals an audible alarm at the dryer and in the CPP control room if the air pressure (i.e., vacuum level) falls below the specified threshold. The operation of this system will be monitored routinely during dryer operations. The operator will perform and document inspections of the vacuum level hourly or more frequently during dryer operations. Additionally, the air pressure differential gauges for other emission control equipment will be observed and documented at least once per shift during dryer operations.

The discharge locations associated with the yellowcake drying and packaging systems will be monitored routinely via filter collection and radiochemical analysis in accordance with NRC license conditions. General plant air also will be monitored routinely for airborne radionuclides.

4.7 Air Quality Impacts

As described in GEIS Section 4.4.6, potential environmental impacts to air quality could occur during all phases of the ISR facility lifecycle (NRC, 2009a). Nonradiological air emission impacts primarily involve fugitive road dust from vehicles traveling on unpaved roads and combustion engine emissions from vehicles and diesel equipment. In general, any nonradiological emissions from pipeline system venting, resin transfer, and elution will be expected to be at such low levels that they will be negligible Such emissions were not considered in the analysis. Radon could also be released from well system relief valves, resin transfer, or elution. Potential radiological air impacts, including radon release impacts, are addressed in the Public and Occupational Health and Safety Impacts analyses in SEIS Section 4.13.

Factors NRC staff used in determining the magnitude of the potential impacts are described in GEIS Section 4.4.6 (NRC, 2009a) and include whether (i) the air quality of the site's region of influence (ROI) is in compliance with the National Ambient Air Quality Standards (NAAQS), (ii) the facility can be classified as a major source under the New Source Review or operating (Title V of the Clean Air Act) permit programs, and (iii) the presence of Prevention of Significant Deterioration (PSD) Class I areas within the region could be impacted by emissions from the proposed action.

GEIS Construction Phase Summary

As discussed in GEIS Section 4.4.6.1, fugitive dust and combustion (vehicle and diesel equipment) emissions during land-disturbing activities associated with construction will be expected to be short term and reduced through BMPs (e.g., wetting of roads and cleared land areas to reduce dust emissions). Estimated ISR-construction-phase fugitive dust annual concentrations used in the GEIS are expected to be well below the $PM_{2.5}$ NAAQS. Additionally, particulate, sulfur dioxide, and nitrogen dioxide concentration estimates used in the GEIS are expected to be below PSD Class II allowable increments (1 to 9 percent) and the stricter Class I increments (7 to 84 percent). NRC staff concluded in the GEIS that for NAAQS attainment areas, nonradiological impacts will be SMALL. (NRC, 2009a)

GEIS Operations Phase Summary

GEIS Section 4.4.6.2 stated that operating ISR facilities are not major point source emitters and are not expected to be classified as major sources under the operation (Title V) permitting program. The GEIS states that the primary nonradiological emissions during operations include fugitive dust and combustion products from equipment, maintenance, transport trucks, and other vehicles. Additionally, NRC staff concluded in the GEIS that any nonradiological emissions from pipeline system venting, resin transfer, and elution will be expected to be at such low levels that they will be negligible and were not considered in the analysis. For NAAQS attainment areas, NRC staff concluded in the GEIS that nonradiological air quality impacts will be SMALL. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

As described in GEIS Section 4.4.6.3, because the same infrastructure will be used during the aquifer restoration as during operations, air quality impacts from aquifer restoration will be similar to, or less than, those during operations. Additionally, fugitive dust and combustion emissions from vehicles and equipment during aquifer restoration will be similar to, or less than, the dust and combustion emissions during operations. For NAAQS attainment areas, NRC staff concluded in the GEIS that nonradiological air quality impacts will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

As discussed in GEIS Section 4.4.6.4, fugitive dust, vehicle emissions, and diesel emissions during land-disturbing activities from the decommissioning phase will come from many of the same sources as the construction phase. In the short term, emission levels are expected to increase given the activity (i.e., demolishing of process and administrative buildings, excavating and removing contaminated soils, and grading of disturbed areas). However, such emissions

will be expected to decrease as decommissioning proceeds, and therefore, overall, impacts will be similar to, or less than, those associated with construction; will be short term; and will be reduced through BMPs (e.g., dust suppression). NRC staff concluded in the GEIS that for NAAQS attainment areas, nonradiological impacts will be SMALL. (NRC, 2009a)
Potential environmental impacts on air quality during construction, operations, aquifer restoration, and decommissioning phases of the proposed Dewey-Burdock ISR Project are discussed in the following sections. The discussion also addresses the impacts on air quality during the peak year. The peak year accounts for the time when all four phases occur simultaneously and represents the highest amount of emissions the proposed action will generate in any 1 year. The applicant identifies 2 years when all four phases will occur simultaneously and 7 years when construction and operation phases will occur simultaneously (Powertech, 2012d). Appendix C describes nonradiological air emissions information for the proposed project including emission inventories and air dispersion modeling.

4.7.1 Proposed Action (Alternative 1)

As described in SEIS Section 3.7.2, the air quality of the Black Hills-Rapid City Intrastate Air Quality Control Region, where the proposed Dewey-Burdock ISR Project is located, is designated as an attainment area for all NAAQS pollutants and is located in a Class II area for PSD designation. The nearest PSD Class I area, Wind Cave National Park, located about 47 km [29 mi] northeast of the proposed Dewey-Burdock ISR Project, is also located in this same air quality control region and is also classified as an attainment area. The attainment status of the air quality surrounding the proposed license area provides a measure of current air quality conditions and affects considerations for allowing new emission sources.

While NRC is responsible for assessing the potential environmental impacts from the proposed action pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, NRC does not have the authority to develop or enforce regulations to control nonradiological air emissions from equipment licensees use. For the proposed Dewey-Burdock ISR Project, this authority rests with SDDENR. To ensure the air quality of South Dakota is adequately protected, in addition to addressing all NRC regulatory requirements for radiological emissions, NRC applicants and licensees must comply with all applicable state and federal air quality regulatory compliance and permitting requirements.
The applicant submitted an air quality application to SDDENR in November, 2012 (see Table 1.6-1). Based on the information in the application, SDDENR determined that an air permit will not be required and the proposed project will not be subject to PSD requirements (SDDENR, 2013b). SDDENR's review of the applicant's air quality application included an assessment of potential greenhouse gas emissions relative to the 90,718 metric tons [100,000 short tons] standard identified in SEIS Section 3.7.2. This regulatory determination conducted by the SDDENR did not include mobile and fugitive sources as categorized in this SEIS (see Table 2.1-5). Since mobile and fugitive sources compose the majority of the project emissions, NRC staff determined that the SEIS analysis would include mobile and fugitive emission sources, as well as stationary sources. NRC staff will characterize the magnitude of air effluents from the proposed project throughout SEIS Section 4.7.1, in part, by comparing (i) the emission levels to PSD and Title V thresholds and (ii) the modeled concentrations to regulatory standards such as NAAQS. This characterization is meant to provide a context for understanding the magnitude of the proposed project's air effluents, which are mostly from mobile and fugitive sources rather than stationary sources. The NRC analysis in this SEIS is for disclosure purposes and does not document or represent the formal SDDENR determination. This is an important distinction to remember when considering the analysis in this SEIS.
The air impact analysis includes two types of modeling: AERMOD and CALPUFF. The AERMOD dispersion model was used to predict NAAQS and PSD pollutant concentrations and the CALPUFF model was used to generate Air Quality Related Values for Wind Cave National

Park. The two types of modeling results and associated analyses will be discussed separately. Additional information concerning the Dewey-Burdock emission inventory, the modeling protocol, and the results for both the AERMOD and CALPUFF analyses is available in the Ambient Air Quality Final Modeling Protocol and Impact Analysis (IML, 2013a).
The model options and approach for the air quality impact assessment selected by NRC staff in this EIS do not completely align with EPA's guidelines on air quality models (40 CFR Part 51, Appendix W). Specifically, deviations from the regulatory default options are utilized. For example, the dry depletion option is used in the AERMOD analysis. The dry depletion option accounts for the partial settling and deposition of PM_{10} particles as the dust plume disperses away from the source. Similarly, the PM_{10} emission is not included in the CALPUFF analysis. NRC determined that it is appropriate to use dry depletion in the AERMOD analysis and exclude PM_{10} from the CALPUFF analysis for three main reasons. First, the nature of the project specific emission supports this decision (i.e., over 99 percent of the fugitive dust emissions are from ground-level emission sources where rapid deposition is expected). Second, modelingusing the regulatory default options can overestimate short-term PM_{10} impacts because the rapid deposition phenomenon is not adequately addressed. Third, EISs for coaland gas development in the western United States address PM_{10} emission in this same manner (TRC Environmental Corporation, 2006; Marquez Environmental Services, Inc., 2010).

SEIS Appendix C Section C.2.3 and Sections 3.2 and 3.9 of the Ambient Air Quality Final Modeling Protocol and Impact Analysis discuss these rationales in greater detail.
The guideline in 40 CFR Part 51, Appendix W is used by EPA, States, and industry to prepare and review new source permits and State Implementation Plan revisions. This guideline recognizes the need to accommodate deviations from default conditions on a case-by-case basis to ensure accuracy. However, the guideline states that such deviations should be fully supported. Staff from EPA, SDDENR, and the Bureau of Land Management participated in the development of the protocol for this SEIS analysis. During the protocol development, EPA in particular expressed a strong preference for the SEIS impact analysis to rely on modeling that did not deviate from regulatory default options. For informational purposes only, at the end of impact assessment for each phase, NRC staff will present the impact analysis using the PM_{10} modeling results that do not implement the AERMOD dry depletion option as well as include the PM_{10} emission in the CALPUFF visibility analysis. However, The NRC staff based its impact analyses (i.e., SMALL, MODERATE, or LARGE) in the SEIS on modeling that deviates from regulatory default options noting the reasons why the staff chose this option.
Expressing the proposed project's emissions in concentrations can help in characterizing the magnitude of the emission levels because thresholds, such as NAAQS and PSD increments, are also expressed in concentrations. The AERMOD dispersion model was used to predict pollutant concentrations at a total of 4,220 receptors that extend in all directions from the project site and fully encompass Wind Cave National Park, the nearest Class I area. Figures 4.7-1 and 4.7-2 display the AERMOD receptor placement (i.e., locations where pollutant concentrations were estimated). The spacing between the receptors is not uniform across the model domain. In general, the receptor spacing is larger as the distance from proposed Dewey-Burdock site increases. The model domain includes fenceline, hot spot grid, intermediate grid, and coarse grid receptors. Fenceline receptors at the proposed Dewey-Burdock site boundary were placed at least every 100 m [109.4 yd] with a receptor placed at each boundary corner. For the hot spot grid, receptors were placed at 100-m [109.4-yd] spacing within a 500-m [546.8-yd] wide corridor along the western and southern portions of the project boundary and along the public road accessing the proposed site. The inclusion of the hot spot grid receptors is based on the initial modeling that predicts that high 24-hour PM_{10} values will be limited to this corridor. The modeling domain consists of two intermediate grids. For the first intermediate grid, receptors were placed at 500-meter [546.8-yard] spacing from the project fenceline outward to a distance

of 5 km [3.11 mi] in all directions from the project center. For the second intermediate grid, receptors were placed at 1-km [0.62-mi] spacing from the outer edge of the first intermediate grid in all directions to a distance of 15 km [9.32 mi] from the project center. Figure 4.7-2 displays the receptor placement of project fenceline, hot spot grid, and intermediate grids. The modeling domain consists of two coarse grids. For the first coarse grid, receptors were placed at 5-km spacing [3.11-mi] from the outer edge of the second intermediate grid outward in all directions to a distance of 35 km [21.7 mi] from the project center. For the second coarse grid, receptors were placed at 10-km [6.21-mi] spacing from the outer edge of the first coarse grid in all directions to a distance of 55 km [34.2 mi] from the project center. Figure 4.7-1 displays the receptor placement of the coarse grids as well as the second intermediate grid. In addition, 44 fenceline receptors were placed at roughly uniform spacing around the Wind Cave National Park boundary.

The modeling was conducted for the peak year emission inventory (see Table 2.1-5) and included stationary (see Table 2.1-1), mobile (see Table 2.1-2), and fugitive dust (see Table 2.1-3) sources. Although the modeling was conducted using one year of emission data (i.e., the peak year), the model uses three years of hourly meteorological data. EPA recommends that AERMOD be run with a minimum of three years of meteorological data (IML, 2013a). Table 4.7-1 presents the AERMOD modeling results with respect to the NAAQS and Table 4.7-2 presents the results with respect to the PSD increments. The NAAQS and PSD thresholds are described in SEIS Section 3.7.2. As described in the notes for Table 4.7-1, the model results form for the NO_2 annual and SO_2 3 hour values are not the same as the NAAQS form. The form expresses both the statistic (e.g., maximum, average, 98th percentile, etc.) and the time period (e.g., once per year, over one year, over 3 years, etc.) associated with a value. As described in the notes for Table 4.7-2, none of the model results forms are the same as the PSD increments forms. The lack of continuity between the model results form and the NAAQS and PSD increment forms, as well as the values used to represent project level concentrations, is addressed in SEIS Appendix C, Section C2.3.1. Additional information concerning the emission inventory, AERMOD modeling protocol, and results is available in the Ambient Air Quality Final Modeling Protocol and Impact Analysis (IML, 2013a).

Figure 4.7-1. Macroscale View of Locations Where National Ambient Air Quality Standards and Prevention of Significant Deterioration Air Pollutant Estimates (Concentrations) Were Calculated Using the AERMOD Dispersion Model
Source: Modified From IML (2013a)

Figure 4.7-2. Microscale View of Locations Where National Ambient Air Quality Standards and Prevention of Significant Deterioration Pollutant Estimates (Concentrations) Were Calculated Using the AERMOD Dispersion Model
Source: Modified From IML (2013a)

described in SEIS Section 3.7.2, the Air Quality Related Values of visibility and acid deposition are also used to characterize the air quality at Class I areas. Evaluation of the impacts on the Air Quality Related Values at Wind Cave National Park was conducted using the CALPUFF model. Figure 4.7-3 identifies the CALPUFF modeling domain. In order to adequately characterize the Air Quality Related Values impacts to Wind Cave National Park, the modeling domain extended 100 km [62 mi] in all directions from the proposed project area, which includes a 50-km [31-mi] buffer around the Class I area to provide meteorological model continuity. Although the modeling domain is large, the 192 model receptors are located only within the Wind Cave National Park itself as shown in Figure 4.7-4. The CALPUFF modeling was conducted for the peak year emission inventory (see Table 2.1-5) and included stationary (see Table 2.1-1), mobile (see Table 2.1-2), and fugitive dust (see Table 2.1-3) sources.

Although the modeling was conducted using one year of emission data (i.e., the peak year), the model uses three years of hourly meteorological data. Modeled emission sources and emission rates are identical to those used in the AERMOD modeling. The visibility impacts are modeled under two scenarios. The first scenario includes the coarse particulate matter (i.e., PM_{10}) when computing the results and the second scenario excludes the PM_{10} from the computation. Project emission of fine particulate matter (i.e., $PM_{2.5}$) is included in both scenarios. The reason for the second scenario is to account for the settling and deposition of heavier particles as the dust plume dissipates from the source. NRC staff will base the impact analyses in this SEIS on the second scenario, which excludes the PM_{10} emissions from the computation. The rationale for the exclusion of the PM_{10} emissions from the computation is presented in Appendix C Section C2.3.1. For information purposes, NRC staff will also present the impact analysis for the first scenario, which includes the PM_{10} emissions in the analysis. The acid deposition impacts are modeled under one scenario using the complete emission inventory. Acid deposition impacts are modeled as the deposition of a variety of compounds containing nitrogen and sulfur. The sulfur dioxide and nitrogen oxides emissions from the proposed project constitute the potential sources of acid deposition.

Table 4.7-1. Nonradiological Concentration Estimates (i.e., AERMOD Modeling Results) From Stationary, Mobile, and Fugitive Sources for the Peak Year* Compared to the National Ambient Air Quality Standards (NAAQS)

Pollutant	Averaging Time	Modeling Results Form†	Modeling Results (ug/m^3)	Background Concentration (ug/m^3)	Total Concentration (ug/m^3)	NAAQS Limit (ug/m^3)	% of NAAQS Limit
Carbon Monoxide	1 hour	Not to be exceeded more than once per year	2101.1	1097.3	3198.4	40000	8.0
	8 hour	Not to be exceeded more than once per year	262.6	315.5	578.1	10000	5.8
Nitrogen Dioxide	1 hour	98th percentile, averaged over 3 years	156.9	5.6	162.5	187	86.9
	Annual	Annual mean‡	3.3	0.4	3.7	100	3.7
Particulate Matter $PM_{2.5}$	24 hour	98th percentile, averaged over 3 years	6.9	10.9	17.8	35	50.9

Table 4.7-1. Nonradiological Concentration Estimates (i.e., AERMOD Modeling Results) From Stationary, Mobile, and Fugitive Sources for the Peak Year* Compared to the National Ambient Air Quality Standards (NAAQS) (Cont'd)

Pollutant	Averaging Time	Modeling Results Form†	Modeling Results (ug/m^3)	Background Concentration (ug/m^3)	Total Concentration (ug/m^3)	NAAQS Limit (ug/m^3)	% of NAAQS Limit
	Annual	Annual mean, averaged over 3 years	1.0	4.8	5.8	12§	48.3
Particulate Matter PM_{10} Initial Run ‖	24 hour	Not to be exceeded more than once per year on average over 3 years	187.2	41.0	228.2	150	152.1
Particulate Matter PM_{10} Final Run¶	24 hour	Not to be exceeded more than once per year on average over 3 years	83.6	41.0	124.6	150	83.1
Sulfur Dioxide	1 hour	99th percentile of 1-hour daily maximum concentrations	48.3	15.7	63.9	200	31.9
	3 hour	Not to be exceeded more than once per year#	100.1	20.9	121.0	1300	9.3

Source: Modified from IML (2013a) and Powertech (2013c)
*Peak year accounts for when all four phases occur simultaneously and represents the highest amount of emission.
†the form expresses both the statistic (e.g., maximum, average, or 98th percentile) and the time period (e.g., once per year, over one year, or over 3 years) associated with the numerical value. Unless otherwise noted, the modeling results form and the NAAQS form are the same.
‡Initial modeling form (maximum annual average over a three year period) is not the same as the NAAQS form (maximum annual average over a single year). The value in this table has a form that matches the NAAQS form and was calculated from the initial model result as described in Appendix C Section C2.3.
§The table identifies the primary standard limit. The secondary standard limit is larger (i.e., 15 µg/m^3). Results that meet the primary standard will automatically meet the secondary standard.
‖Initial modeling run without dry depletion for all receptor locations.
¶Final modeling run with dry depletion for the top 50 receptor locations.
#The model result form (the highest value over any single calendar year) is not the same as the prevention of significant deterioration increment form (not to be exceeded more than once per year). The value in this table has a form that matches the NAAQS form and was calculated from the initial model result as described in Appendix C, Section C2.3.

Table 4.7-2. Nonradiological Concentration Values From Stationary, Mobile, and Fugitive Sources for the
Peak Year* Compared to the Prevention of Significant Deterioration (PSD) Increments

Table 4.7-3 presents the visibility analysis results and Table 4.7-4 presents the acid deposition analysis results. NRC staff considers comparing project emission levels to thresholds useful for characterizing the magnitude of the potential impacts. Both tables compare the project specific results to appropriate thresholds. The visibility analysis in Table 4.7-3 specifies a threshold parameter identified by EPA, U.S. Forest Service (USFS), and FWS. This threshold indicates that a visibility impact on a Class I area is considered significant when the source's contribution to visibility impairment, modeled as the 98th percentile of the daily (i.e., 24-hour), results in changes in deciviews that are equal to or greater than the contribution threshold of 0.5 deciviews (IML, 2013a). Expressed in another way, a source can be reasonably anticipated to cause or contribute to visibility impairment if the 98th percentile change in light extinction (i.e., the scattering of light) is greater than 0.5 deciviews.

Two different thresholds are presented in Table 4.7-4 for comparison to the project acid deposition results. The first threshold is a concern threshold, also called the Deposition Analysis Threshold, established by USFS. Below this threshold, deposition impacts from a source are considered negligible (IML, 2013a). The second threshold is the estimated critical loads for Wind Cave National Park. The term critical load describes the threshold of air pollution deposition below which significant harmful effects on sensitive resources in an ecosystem are not expected to occur. The critical load threshold is an emerging guideline to help in the protection of Class I areas. Table 4.7-4 also presents the measured deposition rates at Wind Cave National P ark. Additional information concerning these thresholds is available in the Ambient Air Quality Final Modeling Protocol and Impact Analysis (IML, 2013a).

The NRC staff conclude that the site-specific conditions at the proposed Dewey-Burdock ISR Project are not bounded by those described in the GEIS for air quality. The estimated emission levels and associated pollutant concentrations for the proposed project described in SEIS Section 2.1.1.1.6.1.1 are greater than those cited in GEIS Table 2.7-2 (NRC, 2009a). The pollutant with the highest emission level for the proposed action is particulate matter PM_{10} with most being generated in the construction phase (see Table 2.1-3). The GEIS estimates that the construction phase an ISR facility generates an annual fugitive dust concentration of 0.28 $\mu g/m^3$ based on a 10.0 metric ton emission level (NRC, 2009a). This estimate did not categorize the particulates as PM_{10} or $PM_{2.5}$. This SEIS estimates that the construction phase of the proposed Dewey-Burdock project generates an annual PM_{10} concentration of 2.4 $\mu g/m^3$ based on a 172 metric ton [190 short ton] emission level and an annual $PM_{2.5}$ concentration of 0.41 $\mu g/m^3$ based on a 18.8 metric ton [20.7 short ton] emission level (see Tables 2.1-5, C–9, and C–10).

The environmental impacts on air quality for each of the liquid waste disposal options the applicant proposed (i.e., deep well disposal via Class V injection wells, land application, or combined deep well disposal and land application) are discussed in the following sections.

4.7.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells. Potential environmental impacts on air quality from construction, operations, aquifer restoration, and decommissioning associated with the Class V injection well disposal option at the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.7.1.1.1 Construction Impacts

To help characterize the magnitude of the proposed project's air effluents, the emission levels are compared to regulatory thresholds, such as the New Source Review program threshold for classification as a major source. The estimated emission levels of NAAQS pollutants for stationary sources for the proposed Dewey-Burdock ISR Project listed in Table 2.1-1 are well below the New Source Review program threshold of 227 metric tons [250 short tons] for classification as a major source as described in SEIS Section 2.1.1.1.6.1.1. The pollutant with the highest stationary source emission level is NO_x at 1.54 metric tons [1.70 short tons]. For the construction phase, all of the estimated annual emission levels of nonradiological pollutants from all sources (i.e., stationary, mobile, and fugitive) were lower than the New Source Review threshold (see Table C–11). The pollutant with the highest emission level is PM_{10} at 172.2 metric tons [189.8 short tons] (see Table 2.1-3). However, for the peak year, the one pollutant emission level that exceeds the New Source Review threshold is PM_{10} at 419.0 metric tons [461.9 short tons] (see Table 2.1-5).

Air emission during the construction phase of the proposed project will consist primarily of combustion emissions and fugitive road dust. The construction phase generates the highest levels of fugitive dust relative to the other phases (see Table 2.1-3). Travel on unpaved roads generates about 84 percent of the PM_{10} emission levels with wind erosion accounting for the remaining 16 percent (see Table 2.1-3). For the mobile combustion emissions, the construction phase generates the highest levels of sulfur dioxide, nitrogen oxides, and carbon monoxide when compared with the other three phases (see Table 2.1-2). For the construction phase combustion emissions, the NAAQS pollutants with the highest emission levels are NO_x and CO (see Table 2.1-2).

The total pollutant concentrations (i.e., the modeling results for the project emissions when added to the background concentration levels) for the initial modeling run reveal that the peak year pollutant concentrations are below the NAAQS, except for the PM_{10} 24-hour estimate (see Table 4.7-1). These concentrations include the stationary sources from Table 2.1-1, the mobile sources from Table 2.1-2, and the fugitive sources from Table 2.1-3. All 50 receptor locations where the PM_{10} 24-hour total pollutant concentration exceeded the NAAQS occur within 500 meters [546.8 yards] of the Dewey-Burdock project boundary and the public road over which commuter traffic accesses the site (IML, 2013a). In fact the receptors with the ten highest PM_{10} 24-hour concentrations occur along the public road rather than the project boundary (IML, 2013a). Fugitive dust sources account for 99.1 percent of the peak year PM_{10} emissions for all sources (see Table C–8). For the construction phase, travel on unpaved roads accounts for 84 percent of the PM_{10} emissions (see Table 2.1-3). This indicates that travel on the unpaved roads is a key source for the fugitive dust estimates. The fact that the exceedences occur for the 24-hour standard and not the annual standard indicates that potential impacts are associated with the short-term time frame.

The initial modeling run for PM_{10} was conducted without implementing the dry depletion option. The AERMOD dry depletion option accounts for the partial settling and deposition of PM_{10} particles as the dust plume disperses away from the source. In simple terms, heavier particles tend to fall out of the air sooner than lighter particles. A more detailed explanation of dry depletion and the rationale for its use in this SEIS is presented in Appendix C Section C2.3.1. NRC staff will base the impact analyses (i.e. SMALL, MODERATE, or LARGE) in this SEIS on the PM_{10} modeling results that implement the dry depletion option (i.e., the final modeling run). For information purposes, NRC staff will also present the impact analysis for the results that do not implement the dry depletion option (i.e., the initial modeling run). However, the impact assessment in this SEIS will not be based on the PM_{10} estimates generated in the initial modeling run. Implementation of the dry depletion option for the final modeling results only changes the PM_{10} estimates. Put another way, the initial modeling results provide the estimates used in the SEIS for all of the pollutants other than PM_{10}. When the modeling implements the dry depletion option, the peak year total concentration for the PM_{10} 24-hour estimate is below the NAAQS (i.e., 83.1 percent) and the estimated peak year total concentrations for all of the pollutants are below the NAAQS ranging between 3.7 and 86.9 percent of the applicable threshold (see Table 4.7.1). As described in Table C–11, the construction phase contribution to the peak year emissions varies between 40.5 and 70.8 percent depending on the particular pollutant. For the construction phase, the total pollutant concentrations for the initial modeling run (i.e. without implementing dry depletion) are below the NAAQS ranging between 2.4 and 78.6 percent of the applicable standard (see Table C–12). This includes the PM_{10} 24-hour estimate which drops from 78.6 percent of the NAAQS to 50.2 percent when dry depletion is implemented (see Table C–12).

While the NAAQS primarily relate to an area's attainment classification (see SEIS Section 3.7.2), the PSD increments relate to pollution levels made by individual projects. The modeling domain for this project included both Class I areas (i.e., Wind Cave National Park) and Class II areas (i.e., all other areas within the domain). Wind Cave National Park is located about 46.7 km [29.0 mi] northeast of the proposed project area, and the predominant wind direction is from the northwest (see Figure 3.7-1). The Class II analysis will be addressed first followed by the Class I analysis.

For the peak year, the estimated PM_{10} 24-hour project level concentration is above the allowable PSD Class II increment for both the initial and final modeling runs (see Table 4.7-2). The estimated project level PM_{10} 24-hour concentration for the final model run is almost three times the PSD Class II increment and the initial modeling result is over six times the PSD Class II increment. The estimated project level concentrations for all of the other pollutants are below the PSD Class II increments ranging between 3 and 87.8 percent of the applicable threshold (see Table 4.7-2). As described in Table C-11, the construction phase contribution to the peak year emissions varies between 40.5 and 70.8 percent depending on the particular pollutant. For the construction phase, the estimated PM_{10} 24-hour project level concentrations for the final

modeling run (34.4 µg/m^3) and initial modeling run (76.9 µg/m^3) are both above the allowable PSD Class II increment of 30 µg/m^3. For all of the other pollutants, the estimated project level concentrations for the construction phase are below the applicable PSD Class II increments.
For the peak year, none of the estimated project level concentrations exceed the allowable Class I PSD increments (see Table 4.7-2). For the final modeling run, the project level concentration estimates range between zero and 45 percent of the applicable threshold. If the initial modeling run is considered, this range increases to 100 percent due to the PM_{10} 24-hour project level concentrations. As described in Table C–11, the construction phase contribution to the peak year emissions varies between 40.5 and 70.8 percent depending on the particular pollutant. For the construction phase, all of the estimated project level concentrations are below the applicable PSD Class I thresholds.
NRC staff consideration of the Air Quality Related Values begins with the peak year analysis for the visibility. Table 4.7-3 presents the visibility analysis results both with and without PM_{10} included in the emission inventory. For the modeled results without the PM_{10} included, the 98th percentile of the annual, 24-hour average change in deciviews is less than the contribution threshold for both the 3-year average as well as for each individual year. There are no days during the 3-year model period with a change in light extinction exceeding 0.5 deciviews. For the modeled results with the PM_{10} included, the 98th percentile of the annual, 24-hour average change in deciviews is also less than the contribution threshold for both the three-year average, as well as for each individual year. However, there are eleven days during the 3-year model period with a change in light extinction exceeding 0.5 deciviews. Visibility impacts are not generated for the individual project phases. The analyses with and without PM_{10} both reveal that the annual peak year results are below the threshold. The individual phase results, as a fraction of the peak year results, are also below the threshold. In addition, the visibility result is a value computed from several pollutants with varying contributions rather than just a single pollutant. This complicates any attempt to generate phase specific contribution values.
Table 4.7-4 presents the total (i.e., wet and dry) acid deposition peak year results for the Wind Cave National Park. The modeled results for the 3-year average are below the concern threshold. This will remain true even if all of the modeled emissions occur in a single year. The modeled results when combined with the measured 3-year average at Wind Cave National Park are below the estimated critical load. This will remain true if the modeled results are combined with any of the single year measured averages. Acid deposition impacts are not generated for the individual project phases. The annual peak year results are below the threshold. The individual phase results, as a fraction of the peak year results, will also be below the threshold.
The air emission inventory used in this SEIS incorporates the following mitigation measures the applicant committed to implement (IML, 2013a and Powertech, 2012d):

- Lowering the drill rig engine horsepower from 550 horsepower to 300 horsepower, except for the deep well drill rig.
- Using Tier 1, or higher, drill rig engines and Tier 3, or higher, construction equipment engines.
- Car pooling.
- Water suppression for unpaved roads.

The various tiers refer to a phased program of federal standards that requires newly manufactured engines to generate lower pollutant emission levels. Higher tier numbers correlate with stricter emission standards and lower pollutant levels. Section C2.1 describes how changes in engines used are incorporated into the calculation of the revised emissions inventory. Table C–5 describes the effectiveness (i.e., the percentage of emissions reduction) implement carpooling. Reducing the number of vehicles commuters use results in fewer emissions and lower pollutant levels. Table C–6 described the effectiveness (i.e., the percent that the emissions are reduced) of the carpooling implemented by the applicant. A 60 percent reduction in the fugitive dust emissions associated with travel on unpaved roads within the proposed project boundary is incorporated into the inventory. The watering frequency of more than twice per hour is the basis for using the 60 percent control efficiency. Appendix D of the Ambient Air Quality Final Modeling Protocol and Impact Analysis (IML, 2013a) provides additional details for the project specific watering control of fugitive dust and the 60 percent control efficiency basis. No reduction in the fugitive dust emission associated with travel on the unpaved road outside of the project boundary is incorporated into the emission inventory. The applicant identified other mitigation measures it will implement (see Table 6.2-1); however, these other measures are not incorporated in the calculation of the revised emissions inventory. In addition, the applicant has proposed the following mitigation measures to further reduce and control air emissions (IML, 2013a and Powertech, 2009a):

- Implement standard dust control measures such as speed limits.
- Coordinate dust-producing activities to reduce maximum dust levels.
- Maintain vehicles to meet applicable EPA emission standards.
- Restore and reseed disturbed areas.
- Assist Fall River County in the maintenance and application of dust suppressant on the unpaved road beyond the project boundary.

All phases of the proposed Dewey-Burdock ISR Project will produce greenhouse gas emissions. Table 2.1-6 presents the carbon dioxide emission estimates for the proposed action for each of the four phases and for the various source categories. The only greenhouse gas included in the emission estimates is carbon dioxide. NRC staff consider the exclusion of other greenhouse gases from the inventory acceptable because carbon dioxide is the primary greenhouse gas emitted by the proposed action (IML, 2013a) and the analysis in this SEIS is for disclosure purposes rather than a formal regulatory determination. SEIS Appendix C Section C3 contains additional information on the greenhouse gas emission estimates presented in Table 2.1-6. The estimated carbon dioxide emission level for the stationary sources is lower than the current EPA permitting threshold, as described in SEIS Section 3.7.2. In fact, both the peak year and construction phase emissions levels for all of the sources (i.e., facility, mobile, and electric consumption) are below this threshold. For comparison, the annual estimated greenhouse gas emissions for the peak year from all sources is 38,621 metric tons [42,572 short tons], which is a small fraction of those produced annually in South Dakota {36.5 million metric tons [40.2 million short tons] of gross CO_2e emissions} (Center for Climate Strategies, 2007). NRC staff conclusions concerning potential greenhouse gas impacts are addressed in SEIS Section 5.7 on air quality cumulative effects.

As described in SEIS Section 4.7.1.1, NRC staff will base the impact analyses (i.e. SMALL, MODERATE, or LARGE) in this SEIS using the PM_{10} modeling results that implement the AERMOD dry depletion option (i.e., the final modeling run) and exclude the PM_{10} emissions from the CALPUFF visibility analysis. The proposed action's dispersion modeling results that address fugitive dust emissions as well as emissions from the burning of fossil fuels for the stationary and mobile sources indicate that pollution concentration levels within the modeling domain are generally low. Pollutant concentrations for both the peak year and construction phase only pollutant concentrations are below the NAAQS. All the estimated project level concentrations for both the peak year and construction phase are below the PSD Class II increments, except for the 24-hour PM_{10} values. As described in SEIS Section 4.7.1, the SDDENR formally determined that the project will not be subject to PSD requirements. Therefore, for this analysis, NRC staff consider comparison of project level pollutant concentrations to PSD increments for disclosure purposes (e.g., indicating the type of project level emission the analysis should focus on for potential environmental impacts) rather than a regulatory concern. For both the peak year and construction phase only, all of the estimated project level concentrations are below the PSD Class I increments. Due to the level (i.e., above

PSD Class II increments) and nature of these fugitive PM_{10} emissions, there is a potential for noticeable localized dust emissions for only the peak year and construction phase. Short-term, intermittent impacts are possible to the area in and around the site, particularly when vehicles travel on unpaved roads. At times, the fugitive emissions will result in a MODERATE impact on air quality for the peak year and construction phase. For the visibility analyses, the annual modeled peak year results are below the contribution threshold. In fact, there are no individual days over the three year period modeling period with a change in light extinction exceeding 0.5 deciviews. For the acid deposition results, the peak year results are below the contribution threshold. The modeled results when combined with the measured results at the Wind Cave National Park are below the estimated critical load. The individual phase results, as a fraction of the peak year results will be below the visibility and acid deposition thresholds. Due to the level of the visibility and acid deposition results relative to the applicable thresholds, NRC staff conclude that that the peak year and construction phase project emission will result in a SMALL impact on air quality.

The NRC staff conclude that the overall impact to air quality during the construction phase for the Class V injection well disposal option will range from SMALL to MODERATE. The NRC staff reiterate that the peak year represents the greatest project impacts and conclude that the peak year impact will range from SMALL to MODERATE.

For information purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The tables and discussion in the SEIS text already include the information for the initial AERMOD modeling results and inclusion of the PM_{10} emission in the CALPUFF visibility analysis. This discussion will focus on distinctions between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for this SEIS and the analysis the NRC is presenting for informational purposes only) that could result in a different impact magnitude conclusion.

There is an important distinction between the initial and final AERMOD modeling runs in terms of the results relative to the NAAQS. For the peak year, the total pollutant concentrations for the initial modeling run reveal that the concentrations for each of the NAAQS pollutants are below the NAAQS except for the PM_{10} 24-hour estimate (see Table 4.7-1). Implementation of the dry depletion option for the peak year total concentrations results in this value being below the standard. The NRC will characterize the initial modeling run results for the peak year concentrations as a LARGE impact, if mitigating measures are not incorporated by the applicant. One factor or measure that could reduce concentrations is the incorporation of mitigation into the emission inventory calculation such as water suppression for travel on unpaved roads beyond the boundary of the proposed project. Other factors that can be considered are the implementation of particulate monitoring and an associated contingency plan that identifies steps that will be undertaken, if the monitoring shows that fugitive dust is an issue. In the Ambient Air Quality Final Modeling Protocol and Impact Analysis, the applicant expressed willingness to perform air monitoring. During interactions with the NRC, EPA staff recommended the development of a contingency plan associated with such monitoring. However, NRC staff will not require additional measures be undertaken by the applicant because the impact analyses based on the modeling results implementing the deviations from the default conditions correctly estimate the impact magnitude. NRC suggests that the applicant coordinate with appropriate entities, such as Fall River County, for mitigation to the unpaved public road outside the proposed project boundary, or the SDDENR and EPA for fugitive dust monitoring and associated contingency plans.

Although there is a distinction between the initial and final AERMOD modeling runs for the peak year analysis, this is not an issue for the construction phase analysis because both the initial and final modeling PM_{10} 24-hour results are below the NAAQS. NRC staff acknowledge that, for the visibility analysis that includes PM_{10}, there are eleven days during the three-year modeling period where the change in light extinction exceeds 0.5 deciviews. NRC staff further acknowledge that some may consider a statistic other than the 98th percentile (e.g., the maximum change in deciviews or the number of day greater than a 0.5 change in deciviews) the appropriate value to determine the impact magnitude. However, NRC staff considers the 98th percentile statistic as an appropriate basis for determining the impact magnitude. As a result, there is no difference in impact magnitude between the analyses with and without PM_{10}.

4.7.1.1.2 Operations Impacts

The estimated emission levels of NAAQS pollutants for stationary sources for the proposed action listed in Table 2.1-1 are well below the Title V or operating permit threshold of 90.7 metric tons [100 short tons] for classification as a major source in an attainment area as described in SEIS Section 2.1.1.1.6.1.1. The pollutant with the highest stationary source emission level is NO_x at 1.54 meteric tons [1.70 short tons]. For the operation phase, all of the estimated annual emission levels of nonradiological pollutants from all sources were lower than the operating permit threshold, except for PM_{10} at 138.3 metric tons [152.4 short tons] (see Table 2.1-3 and Table C–11). For the peak year, the only pollutant emission level that exceeds the operating permit threshold is PM_{10} at 419.0 metric tons [461.9 short tons] (see Table 2.1-5).

Air emissions during the operation phase of the proposed Dewey-Burdock ISR Project will consist primarily of combustion emissions and fugitive road dust. Travel on unpaved roads generates about 81 percent of the PM_{10} emission levels with wind erosion accounting for the remaining 19 percent (see Table 2.1-3). For the operations phase combustion emissions, the NAAQS pollutants with the highest emission levels are NO_x and CO (see Table 2.1-2). The construction phase analysis in SEIS Section 4.7.1.1.1 discusses the inclusion of mitigation in the calculation of the emissions inventory and the effectiveness of this mitigation. This information also applies to the operation phase impact analysis. In addition, the applicant has proposed other mitigation measures to further reduce and control air emissions (see Table6.2-1).

The discussion of the peak year project level emissions compared to the NAAQS, Class II PSD increments, and Class I PSD increments presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. As described in Table C–11, the operation phase contribution to the peak year emissions varies between 15.8 and 33.0 percent depending on the particular pollutant. For the operation phase, the total pollutant concentrations for the initial modeling run are below the NAAQS ranging between 1.1 and 68.5 percent of the applicable standard (see Table C–13). This includes the PM_{10} 24-hour estimate, which drops from 68.5 percent of the NAAQS to 45.7 percent when dry depletion is implemented (see Table C–13). The estimated operation phase PM_{10} 24-hour project level concentration for the final modeling run (27.6 $\mu g/m^3$) is below the allowable PSD Class II increment, while the initial modeling run value (61.8 $\mu g/m^3$) remains above this threshold. For all of the other pollutants, the estimated project level concentrations for the operations phase are below the applicable PSD Class II increments. For the peak year, none of the estimated projected level concentrations for both the initial and final modeling run exceed the applicable Class I PSD increment (see Table 4.7-2). The estimated projected level concentrations for the operation phase, as a fraction of the peak year results, are also below the PSD Class I increments.

As described in SEIS Section 4.7.1.1.1, Air Quality Related Value impacts are not generated for the individual project phases. Instead, the impacts are based on the peak year values. The analysis presented here is a summary of the analysis presented in SEIS Section 4.7.1.1.1. For the visibility analysis, the modeled peak year results with and without the PM_{10} included are both below the contribution threshold. With the PM_{10} emissions included there are eleven days over the three-year period with a change in light extinction that exceeds 0.5 deciviews. The acid deposition peak year results were below the applicable thresholds. The operation phase results, as a fraction of the peak year results, will also be below the applicable visibility and acid deposition thresholds.

The operations phase generates the most overall carbon dioxide emissions relative to the other three phases. Table 2.1-6 presents the carbon dioxide emission estimates for the proposed action for each of the phases and for the various source categories. The annual estimated carbon dioxide emission for the operation phase from all sources (i.e., facility, mobile, and electrical consumption) were 25,466 metric tons [28,072 short tons]. Stationary sources accounted for less than 6 percent of the overall carbon dioxide emissions (Table 2.1-6). These estimated levels of carbon dioxide gas emissions are lower than the current EPA permitting threshold as described in SEIS Section 3.7.2. NRC staff conclusions concerning potential greenhouse gas impacts are addressed in SEIS Section 5.7 on air quality cumulative effects.

As described in SEIS Section 4.7.1.1, NRC staff will base the impact analyses (i.e. SMALL, MODERATE, or LARGE) in this SEIS using the PM_{10} modeling results that implement the AERMOD dry depletion option (i.e., the final modeling run) and excluding the PM_{10} emissions from the CALPUFF analysis. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. The discussion here will focus on the operation phase impact magnitude. The proposed action's dispersion modeling results, that address fugitive dust emissions as well as emissions from the burning of fossil fuels for the stationary and mobile sources associated with the operation phase, indicate that pollution concentration levels within the modeling domain are generally low. For the final modeling run, the operation phase pollutant concentrations are below the applicable NAAQS, Class II PSD increments, and Class I PSD increments. Due to the level of the operation phase pollutant concentrations, NRC staff conclude that the pollutant concentrations when compared to applicable NAAQS and PSD increments will result in a SMALL impact on air quality. For the visibility analyses, the annual modeled peak year results are below the contribution threshold. There are no individual days over the three year period modeling period with a change in light extinction exceeding 0.5 deciviews. For the acid deposition results, the peak year results are below the contribution threshold. The modeled results when combined with the measured results at the Wind Cave National Park are below the estimated critical load. The individual phase results, as a fraction of the peak year results, will be below the visibility and acid deposition thresholds. Due to the level of the visibility and acid deposition results relative to the applicable thresholds, NRC staff conclude that that operation phase project emissions will result in a SMALL impact on air quality.

The NRC staff conclude that the overall impact to air quality during the operation phase for the Class V injection well disposal option will be SMALL. The NRC staff reiterate that the peak year represents the greatest project impacts and, as described in SEIS Section 4.7.1.1.1, conclude that the peak year impact will range from SMALL to MODERATE.

For information purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The tables and discussion in the SEIS text already include the information for the initial AERMOD modeling results and inclusion of the PM_{10} emission in the CALPUFF visibility analysis. This discussion will focus on distinctions between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for this SEIS and the analysis the NRC is presenting for informational purposes only) that could result in a different impact magnitude conclusion. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. Without additional consideration (e.g., incorporation of additional mitigation into the emission inventory), NRC will characterize the initial modeling run results for the peak year concentrations as a LARGE impact.

When considering the operation phase, there is an important distinction between the initial and final AERMOD modeling runs in terms of the results relative to the Class II PSD increments. The estimated PM_{10} 24-hour project level concentrations for the final modeling run is below the allowable PSD Class II increment, while the estimated PM_{10} 24-hour project level concentration for the initial modeling run value is above this threshold. For the initial modeling run, due to the level (i.e., above PSD Class II increments) and nature of these fugitive PM_{10} emissions, there is a potential for noticeable localized dust emissions for both the peak year and operation phase only. Short-term, intermittent impacts are possible to the area in and around the site, particularly when vehicles travel on unpaved roads. At times, the fugitive emission will result in a MODERATE impact on air quality. This conclusion differs from the final modeling run results analysis, which classifies the PM_{10} 24-hour Class II impacts as SMALL.

4.7.1.1.3 Aquifer Restoration Impacts

Air emissions during the aquifer restoration phase of the proposed Dewey-Burdock ISR Project will consist primarily of combustion emissions and fugitive road dust. For the proposed project, the aquifer restoration phase generates by far the lowest levels of air emission relative to the other three phases. For the aquifer restoration phase combustion emissions, the NAAQS pollutants with the highest emission levels are NO_x and CO (see Table 2.1-2). The construction phase analysis in SEIS Section 4.7.1.1.1 discusses the inclusion of mitigation in the calculation of the emissions inventory and the effectiveness of this mitigation. This information also applies to the aquifer restoration phase impact analysis. In addition, the applicant has proposed other mitigation measures to further reduce and control air emissions (see Table 6.2-1).

The discussion of the peak year project level emission compared to the NAAQS, Class II PSD increments, and Class I PSD increments presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. As described in Table C–11, the aquifer restoration phase contribution to the peak year emissions varies between 0.5 and 5.5 percent depending on the particular pollutant. For the aquifer restoration phase, the total pollutant concentrations for the initial modeling run are below the NAAQS ranging between 0.5 and 40.5 percent of the applicable standard (see Table C–14). This includes the PM_{10} 24-hour estimate, which drops from 33.3 percent of the NAAQS to 30.0 percent when dry depletion is implemented (see Table C–14). All of the estimated aquifer restoration phase project level pollutant concentrations, including the PM_{10} 24-hour final modeling run (4.0 $\mu g/m^3$) and initial modeling run (9.0 $\mu g/m^3$) estimates, are below the applicable PSD Class II increments. For the peak year, none of the estimated projected level concentrations for both the initial and final modeling run exceed the applicable Class I PSD increment (see Table 4.7-2). The estimated projected level concentrations for the aquifer restoration phase, as a fraction of the peak results, are also below the PSD Class I increments.

As described in SEIS Section 4.7.1.1.1, Air Quality Related Value impacts are not generated for the individual project phases. Instead, the impacts are based on the peak year values. The analysis presented here is a summary of the analysis presented in SEIS Section 4.7.1.1.1. For the visibility analysis, the modeled peak year results with and without the PM_{10} included are both below the contribution threshold. With the PM_{10} emissions included there are eleven days over the three-year period with a change in light extinction exceeding 0.5 deciviews. The acid deposition peak year results were below the applicable thresholds. The aquifer restoration phase results, as a fraction of the peak year results, will also be below the applicable visibility and acid deposition thresholds.

Overall, the total carbon dioxide emissions from the aquifer restoration phase are about three times lower than the operations phase (see Table 2.1-6). Most of the aquifer restoration phase carbon dioxide gas emissions are attributed to indirect electrical consumption (Table 2.1-6). The estimated aquifer restoration phase levels of carbon dioxide emission from all sources is lower than the current EPA permitting threshold as described in SEIS Section 3.7.2. NRC staff conclusions concerning potential greenhouse gas impacts are addressed in SEIS Section 5.7 on air quality cumulative effects.

As described in SEIS Section 4.7.1.1, NRC staff will base the impact analyses (i.e. SMALL, MODERATE, or LARGE) in this SEIS using the PM_{10} modeling results that implement the AERMOD dry depletion option (i.e., the final modeling run) and excluding the PM_{10} emissions from the CALPUFF analysis. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. The discussion here will focus on the aquifer restoration phase impact magnitude. The proposed action's dispersion modeling results that address fugitive dust emissions as well as emissions from the burning of fossil fuels for the stationary and mobile sources associated with the aquifer restoration phase indicate that pollution concentration levels within the modeling domain are low. For the final modeling run, the aquifer restoration phase pollutant concentrations are below the applicable NAAQS, Class II PSD increments, and Class I PSD increments. Due to the level of the aquifer restoration phase pollutant concentrations, NRC staff conclude that the pollutant concentrations when compared to applicable NAAQS and PSD increments will result in a SMALL impact on air quality. For the visibility analyses, the annual modeled peak year results are below the contribution threshold. There are no individual days over the three year period modeling period with a change in light extinction exceeding 0.5 deciviews. For the acid deposition results, the peak year results are below the contribution threshold. The modeled results when combined with the measured results at the Wind Cave National Park are below the estimated critical load. The individual phase results, as a fraction of the peak year results, will be below the visibility and acid deposition thresholds. Due to the level of the visibility and acid deposition results relative to the applicable thresholds, NRC staff concludes that the aquifer restoration phase project emission will result in a SMALL impact on air quality.

The NRC staff conclude that the overall impact to air quality during the aquifer restoration phase for the Class V injection well disposal option will be SMALL. The NRC staff reiterate that the peak year represents the greatest project impacts and, as described in SEIS Section 4.7.1.1.1, conclude that the peak year impact will range from SMALL to MODERATE.

For information purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The tables and discussion in the SEIS text already include the information for the initial AERMOD modeling results and inclusion of the PM_{10} emission in the CALPUFF visibility analysis. This discussion will focus on distinctions between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for this SEIS and the analysis the NRC is presenting for informational purposes only) that could result in a different impact magnitude conclusion. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. Without additional consideration (e.g., incorporation of additional mitigation into the emission inventory), NRC will characterize the initial modeling run results for the peak year concentrations as a LARGE impact. When considering the aquifer restoration phase, there are no distinctions between the two analyses that will result in a difference in impact magnitude conclusions.

4.7.1.1.4 Decommissioning Impacts

Air emissions during the decommissioning phase of the proposed Dewey-Burdock ISR Project will consist primarily of combustion emissions and fugitive road dust. For the decommissioning phase combustion emissions, the NAAQS pollutants with the highest emission levels are NO_x and CO (see Table 2.1-2). The construction phase analysis in SEIS Section 4.7.1.1.1 discusses the inclusion of mitigation in the calculation of the emissions inventory and the effectiveness of this mitigation. This information also applies to the aquifer restoration phase impact analysis. In addition, the applicant has proposed other mitigation measures to further reduce and control air emissions (see Table 6.2-1).

The discussion of the peak year project level emission compared to the NAAQS, Class II PSD increments, and Class I PSD increments presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. As described in Table C–11, the decommissioning phase contribution to the peak year emissions varies between 12.1 and 21.2 percent depending on the particular pollutant. For the decommissioning phase, the total pollutant concentrations for the initial modeling run are below the NAAQS, ranging between 1.0 and 53.7 percent of the applicable standard (see Table C–15). This includes the PM_{10} 24-hour estimate, which drops from 53.7 percent of the NAAQS to 39.1 percent when dry depletion is implemented (see Table C–15). The estimated decommissioning phase PM_{10} 24-hour project level concentrations for the final modeling run (17.6 µg/m^3) are below the allowable PSD Class II increment, while the initial modeling run value (39.5 µg/m^3) remains above this threshold. For all of the other pollutants, the estimated project level concentrations for this phase are below the applicable PSD Class II increments. For the peak year, none of the estimated projected level concentrations for both the initial and final modeling run exceeds the applicable Class I PSD increment (see Table 4.7-2). The estimated projected level concentrations for the decommissioning phase, as a fraction of the peak year results, are also below the PSD Class I increments.

As described in SEIS Section 4.7.1.1.1, Air Quality Related Value impacts are not generated for the individual project phases. Instead, the impacts are based on the peak year values. The analysis presented here is a summary of the analysis presented in SEIS Section 4.7.1.1.1. For the visibility analysis, the modeled peak year results with and without the PM_{10} included are both below the contribution threshold. With the PM_{10} emissions included there are eleven days over the three-year period with a change in light extinction exceeding 0.5 deciviews. The acid deposition peak year results were below the applicable thresholds. The decommissioning phase results, as a fraction of the peak year results, will also be below the applicable visibility and acid deposition thresholds.

All phases of the proposed Dewey-Burdock ISR Project generate carbon dioxide, with the operations phase producing the most. Overall, the total carbon dioxide emissions from the decommissioning phase are about 8 times lower than the operations phase (see Table 2.1-6). The estimated decommissioning phase level of carbon dioxide emissions from all sources is lower than the current EPA permitting threshold described in SEIS Section 3.7.2. NRC staff conclusions concerning potential greenhouse gas impacts are addressed in SEIS Section 5.7 on air quality cumulative effects.

As described in SEIS Section 4.7.1.1, NRC staff will base the impact analyses (i.e. SMALL, MODERATE, or LARGE) in this SEIS on PM_{10} modeling results that implement the AERMOD dry depletion option (i.e., the final modeling run) and exclude the PM_{10} emissions from the CALPUFF analysis. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. The discussion here will focus on the decommissioning phase impact magnitude. The proposed action dispersion modeling results addressing fugitive dust emissions as well as emissions from the burning of fossil fuels for the stationary and mobile sources associated with the decommissioning phase indicate that pollution concentration levels within the modeling domain are generally low. For the final modeling run, the decommissioning phase pollutant concentrations are below the applicable NAAQS, Class II PSD increments, and Class I PSD increments. Due to the level of the decommissioning phase pollutant concentrations, NRC staff conclude that the pollutant concentrations when compared to applicable NAAQS and PSD increments will result in a SMALL impact on air quality. For the visibility analyses, the annual modeled peak year results are below the contribution threshold. There are no individual days over the three year modeling period with a change in light extinction exceeding 0.5 deciviews. For the acid deposition results, the peak year results are below the contribution threshold. The modeled results when combined with the measured results at Wind Cave National Park are below the estimated critical load. The individual phase results, as a fraction of the peak year results, will be below the visibility and acid deposition thresholds. Due to the level of the visibility and acid deposition results relative to the applicable thresholds, NRC staff conclude that the decommissioning phase project emission will result in a SMALL impact on air quality. The NRC staff conclude that the overall impact to air quality during the decommissioning phase for the Class V injection well disposal option will be SMALL. The NRC staff reiterate that the peak year represents the greatest project impacts and, as described in SEIS Section 4.7.1.1.1, conclude that the peak year impact will range from SMALL to MODERATE.

For information purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The tables and discussion in the SEIS text already include the information for the initial AERMOD modeling results and inclusion of the PM_{10} emission in the CALPUFF visibility analysis. This discussion will focus on distinctions between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for this SEIS and the analysis the NRC is presenting for informational purposes only) that could result in a different impact magnitude conclusion. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. Without additional consideration (e.g., incorporation of additional mitigation into the emission inventory), NRC will characterize the initial modeling run results for the peak year concentrations as a LARGE impact.

When considering the decommissioning phase, there is an important distinction between the initial and final AERMOD modeling runs in terms of the results relative to the Class II PSD increments. The estimated PM_{10} 24-hour project level concentrations for the final modeling run is below the allowable PSD Class II increment, while the estimated PM_{10} 24-hour project level concentration for the initial modeling run value is above this threshold. For the initial modeling run, due to the level (i.e., above PSD Class II increments) and nature of these fugitive PM_{10} emissions, there is a potential for noticeable localized dust emissions for the decommissioning phase. Short-term, intermittent impacts are possible to the area in and around the site, particularly when vehicles travel on unpaved roads. At times, the fugitive emission will result in a MODERATE impact on air quality. This conclusion is different from the final modeling run results analysis, which classifies the PM_{10} 24-hour Class II impacts as SMALL.

4.7.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant proposes to dispose of liquid waste generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). Potential environmental impacts on air quality from construction, operations, aquifer restoration, and decommissioning associated with the land application liquid waste disposal option are discussed in the following sections. The discussion also addresses the impacts on air quality during the peak year when all four phases occur simultaneously.

4.7.1.2.1 Construction Impacts

When examining combustion emissions, the land application liquid waste disposal option will not require the drilling of up to eight Class V deep disposal wells. The percentage of combustion emission from drill rigs (excluding the deep well rig) ranges from 45 to 70 percent depending on the pollutant (see Table C–2). However, the drilling of eight Class V deep disposal wells constitutes no more than one half of 1 percent of the construction phase emissions for any single NAAQS pollutant. NRC staff conclude that the elimination of drilling the Class V deep disposal wells will result in a very small reduction in the NAAQS pollutant emissions generated. The source that generates the majority of remaining combustion emissions is the construction and drilling field equipment (see Table C–2). As detailed in Table 4.2-1, the land application option will result in more land being disturbed than in the deep well disposal option. Specifically, the land application will require 425.7 ha [1,052 ac] of irrigation area and an additional 41.6 ha [103 ac] for impoundments. These types of land disturbances, particularly the addition of irrigation areas, will not be expected to generate many air emissions from the use of construction or field equipment. The amount of land disturbed for wellfields, access roads, trunkline installation, and site buildings is identical for the deep well disposal and land application options. These types of land disturbances will be associated with the generation of air emissions from construction and field equipment use. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small increase in the NAAQS pollutants generated from combustion emission sources other than the drilling rigs.

For combustion emissions, NRC staff do not expect to see any appreciable difference in the overall NAAQS emission levels between the land disposal option and the deep well disposal option. Therefore, the magnitude of the air quality impacts will be expected to the same for the two disposal options for both the construction phase and the peak year (i.e., all phases combined).

The land application option analysis for greenhouse gases will mirror the NAAQS pollutant analyses because the combustion emission sources for the NAAQS pollutants and the greenhouse gases are the same. Using the same rationale as the NAAQS pollutant analysis, NRC staff do not expect to see any appreciable difference in the overall greenhouse gas emission levels between the land disposal option and the deep well disposal option for the construction phase. The impact analysis for greenhouse gases is addressed in SEIS Section 5.7 on air quality cumulative effects.

Fugitive emissions are generated by both travel on unpaved roads and wind erosion of disturbed land. For the construction phase, travel on unpaved roads is the main source of fugitive emissions. As described in Table 4.2-1, the land application option will not require more access roads to be constructed. Furthermore, the land application option will not require additional land for wellfield or facility construction. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small change in fugitive emissions from travel on unpaved roads.

The amount of fugitive emissions from wind erosion is a function of the amount of disturbed land. The two liquid waste disposal options vary in the amount of land disturbed and, therefore, the amount of fugitive dust generated. As described in Table 2.1-4, the annual mass flow emission rate estimates from wind erosion varied little over the project lifetime with the deep well and land application options generating 10.1 metric tons [11.1 short tons] and 29.7 metric ton [32.7 short tons] of PM_{10}, respectively. When considered in conjunction with the fugitive emissions from unpaved roads, the peak year land application option will generate about 5 percent more PM_{10} emissions and about 7 percent more $PM_{2.5}$ than the deep well disposal option. When wind erosion emissions are considered in conjunction with fugitive emissions from unpaved roads, the construction phase land application option will generate about 10 percent more PM_{10} emissions and about 14 percent more $PM_{2.5}$ than the deep well disposal option.

Although there is some difference in the overall fugitive dust emission levels between the two disposal options, the impact magnitude will be expected to be similar. Therefore, the analyses presented for the deep well disposal option will still apply.

As mentioned earlier in this section, the magnitude of the air quality impacts will be expected to be the same for the two disposal options for both the construction phase and the peak year (i.e., all phases combined). The low level of combustion emissions will result in a SMALL impact on air quality. At times, fugitive emissions will result in a MODERATE impact on air quality from localized dust emissions that are short term and intermittent in nature. The NRC staff conclude that the overall impact on air quality during the construction phase for the land application disposal option will range from SMALL to MODERATE.

For informational purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The only difference between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for the SEIS and the analysis the NRC is presenting for informational purposes only) for the peak year and construction phase only impact assessment is that NRC staff will characterize the initial modeling run results for the peak year concentrations as a LARGE impact based on the PM_{10} 24-hour emission levels. The magnitude of the difference in the PM_{10} emission levels between the two disposal options will not be expected to change this impact assessment.

4.7.1.2.2 Operation Impacts

For the operations phase, combustion emissions for NAAQS pollutants are basically evenly divided between the light duty vehicles and the construction and drilling field equipment (see Table C–2). As detailed in Table 4.2-1, the land application option will result in more land being disturbed than in the deep well disposal option. Specifically, the land application will require 425.7 ha [1,052 ac] of irrigation area and an additional 41.6 ha [103 ac] for impoundments. These types of land disturbances, particularly the addition of irrigation areas, will not be expected to generate many air emissions from the use of construction or field equipment. The amount of land disturbed for wellfields, access roads, trunkline installation, and site buildings is identical for the deep well disposal and land application options. These types of land disturbances will be more associated with the generation of air emissions from construction and field equipment use. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small increase in the NAAQS pollutants generated from combustion emission sources.

For combustion emissions, NRC staff do not expect to see any appreciable difference in the overall NAAQS emission levels between the land disposal option and the deep well disposal option. Therefore, the magnitude of the air quality impacts will be expected to the same for the two disposal options for the operation phase.

The land application option analysis for greenhouse gases will mirror the NAAQS pollutant analyses because the combustion emission sources for the NAAQS pollutants and the greenhouse gases are the same. Using the same rationale as the NAAQS pollutant analysis, NRC staff do not expect to see any appreciable difference in the overall greenhouse gas emission levels between the land disposal option and the deep well disposal option for the operation phase. The impact analysis for greenhouse gases is addressed in SEIS Section 5.7 on air quality cumulative effects.

Fugitive emissions are generated by both travel on unpaved roads and wind erosion of disturbed land. For the operation phase, travel on unpaved roads is the main source of fugitive emissions. As described in Table 4.2-1, the land application option will not require more access roads to be constructed. Furthermore, the land application option will not require additional land for wellfield or facility construction. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small change in fugitive emissions from travel on unpaved roads.

The amount of fugitive emissions from wind erosion is a function of the amount of disturbed land. The two liquid waste disposal options vary in the amount of land disturbed and, therefore, the amount of fugitive dust generated. As described in Table 2.1-4, the annual mass flow emission rate estimates from wind erosion varied little over the project lifetime with the deep well and land application options generating 10.1 metric tons [11.1 short tons] and 29.7 metric ton [32.7 short tons] of PM_{10}, respectively. When wind erosion emissions are considered in conjunction with fugitive emissions from unpaved roads, the operation phase land application option will generate about 12 percent more PM_{10} emissions and about 17 percent more $PM_{2.5}$ than the deep well disposal option.

Although there is some difference in the overall fugitive dust emission levels between the two disposal options, the impact magnitude will be expected to be similar. Therefore, the analyses presented for the deep well disposal option will still apply.

As mentioned earlier in this section, the magnitude of the air quality impacts will be expected to the same for the two disposal options for the operation phase. The NRC staff conclude that the operation phase pollutant concentrations when compared to applicable NAAQS, PSD increments, visibility thresholds, and acid deposition thresholds will result in a SMALL impact on air quality. The NRC staff conclude that the overall impact on air quality during the operation phase for the land application disposal option will be SMALL.

For informational purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The only difference between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for the SEIS and the analysis the NRC is presenting for informational purposes only) for the operation phase impact assessment is that NRC staff will characterize the initial modeling run results as MODERATE at times because of the PM_{10} 24-hour concentrations relative to the PSD Class II increment. The magnitude of the difference in the PM_{10} emission levels between the two disposal options will not be expected to change this impact assessment.

4.7.1.2.3 Aquifer Restoration Impacts

For the aquifer restoration phase, combustion emissions are limited to light duty vehicles (see Table C–2). As detailed in Table 4.2-1, the land application option will result in more land being disturbed than in the deep well disposal option. Specifically, the land application will require 425.7 ha [1,052 ac] of irrigation area and an additional 41.6 ha [103 ac] for impoundments. These types of land disturbances, particularly the addition of irrigation areas, will not be expected to generate much change in air emissions from light duty vehicles. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small increase in the NAAQS pollutants generated from combustion emission sources.

For combustion emissions, NRC staff do not expect to see any appreciable difference in the overall NAAQS emission levels between the land disposal option and the deep well disposal option. Therefore, the magnitude of the air quality impacts will be expected to the same for the two disposal options for the aquifer restoration phase.

The land application option analysis for greenhouse gases will mirror the NAAQS pollutant analysis because the combustion emission sources for the NAAQS pollutants and the greenhouse gases are the same. Using the same rationale as the NAAQS pollutant analysis, NRC staff do not expect to see any appreciable difference in the overall greenhouse gas emission levels between the land disposal option and the deep well disposal option for the aquifer restoration phase. The impact analysis for greenhouse gases is addressed in SEIS Section 5.7 on air quality cumulative effects.

Fugitive emissions are generated by both travel on unpaved roads and wind erosion of disturbed land. For the aquifer restoration phase, wind erosion generates more fugitive emissions than travel on unpaved roads. As described in Table 4.2-1, the land application option will not require more access roads to be constructed. Furthermore, the land application option will not require additional land for wellfield or facility construction. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small change in fugitive emissions from travel on unpaved roads.

The amount of fugitive emissions from wind erosion is a function of the amount of disturbed land. The two liquid waste disposal options vary in the amount of land disturbed and, therefore, the amount of fugitive dust generated. As described in Table 2.1-4, the annual mass flow emission rate estimates from wind erosion varied little over the project lifetime with the deep well and land application options generating 10.1 metric tons [11.1 short tons] and 29.7 metric ton [32.7 short tons] of PM_{10}, respectively. When wind erosion emissions are considered in conjunction with fugitive emissions from unpaved roads, the aquifer restoration phase land application option will generate about 46 percent more PM_{10} emissions and about 51 percent more $PM_{2.5}$ than the deep well disposal option.

Although there is some difference in the overall fugitive dust emission levels between the land disposal option and the deep well disposal option, the impact magnitude will be expected to be similar. Therefore, the analyses presented for the deep well disposal option will still apply.

As mentioned earlier in this section, the magnitude of the air quality impacts will be expected to be the same for the two disposal options for the aquifer restoration phase. The NRC staff conclude that the aquifer restoration phase pollutant concentrations when compared to applicable NAAQS, PSD increments, visibility thresholds, and acid deposition thresholds will result in a SMALL impact on air quality. The NRC staff conclude that the overall impact on air quality during the aquifer restoration phase for the land application disposal option will be SMALL.

For informational purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF visibility analysis. When considering the aquifer restoration phase, there are no distinctions between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for the SEIS and the analysis the NRC is presenting for informational purposes only) that will result in a difference in impact magnitude conclusions. NRC staff conclude that the aquifer restoration phase pollutant concentrations when compared to applicable NAAQS, PSD increments, visibility thresholds, and acid deposition thresholds will result in a SMALL impact on air quality. The magnitude of the difference in the emission levels between the two disposal options will not be expected to change this impact assessment.

4.7.1.2.4 Decommissioning Impacts

For the decommissioning phase, the majority of the combustion emissions are from the construction and drilling field equipment. As detailed in Table 4.2-1, the land application option will result in more land being disturbed than in the deep well disposal option. Specifically, the land application will require 425.7 ha [1,052 ac] of irrigation area and an additional 41.6 ha [103 ac] for impoundments. Reclaiming the additional disturbed land, particularly the impoundments, could result in a slight increase in the emissions from construction and drilling field equipment. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small increase in the NAAQS pollutants generated from combustion emission sources.

For combustion emissions, NRC staff do not expect to see any appreciable difference in the overall NAAQS emission levels between the land disposal option and the deep well disposal option. Therefore, the magnitude of the air quality impacts will be expected to the same for the two disposal options for the decommissioning phase.

The land application option analysis for greenhouse gases will mirror the NAAQS pollutant analysis because the emission sources for the NAAQS and greenhouse gases are the same. Using the same rationale as the NAAQS pollutant analysis, NRC staff do not expect to see any appreciable difference in the overall greenhouse gas emission levels between the land disposal option and the deep well disposal option for the decommissioning phase. The impact analysis for greenhouse gases is addressed in SEIS Section 5.7 on air quality cumulative effects.

Fugitive emissions are generated by both travel on unpaved roads and wind erosion of disturbed land. For the decommissioning phase, travel on unpaved roads is the main source of fugitive emissions. As described in Table 4.2-1, the land application option will not require more access roads to be constructed. Furthermore, the land application option will not require additional land for wellfield or facility construction. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small change in fugitive emissions from travel on unpaved roads.

The amount of fugitive emissions from wind erosion is a function of the amount of disturbed land. The two liquid waste disposal options vary in the amount of land disturbed and, therefore, the amount of fugitive dust generated. As described in Table 2.1-4, the annual mass flow emission rate estimates from wind erosion varied little over the project lifetime with the Class V deep injection well and land application options generating 10.1 metric tons [11.1 short tons] and 29.7 metric ton [32.7 short tons] of PM_{10}, respectively. When wind erosion emissions are considered in conjunction with fugitive emissions from unpaved roads, the decommissioning phase land application option will generate about 18 percent more PM_{10} emissions and about 23 percent more $PM_{2.5}$ than the deep well disposal option.

Although there is some difference in the overall fugitive dust emission levels between the two disposal options, the impact magnitude will be expected to be similar. Therefore, the analyses presented for the deep well disposal option will still apply.

As mentioned earlier in this section, the magnitude of the air quality impacts will be expected to be the same for the two disposal options for decommissioning phase. The NRC staff conclude that the decommissioning phase pollutant concentrations when compared to applicable NAAQS and PSD increments will result in a SMALL impact on air quality. The NRC staff conclude that the overall impact on air quality during the decommissioning phase for the land application disposal option will be SMALL.

For informational purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The only difference between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for the SEIS and the analysis the NRC is presenting for informational purposes only) for the decommissioning phase impact assessment is that NRC staff will characterize the initial modeling run results as MODERATE at times because of the PM_{10} 24-hour concentrations relative to the PSD Class II increment. The magnitude of the difference in the PM_{10} emission levels between the two disposal options will not be expected to change this impact assessment.

4.7.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the proposed Dewey-Burdock ISR Project, the applicant has proposed to dispose of liquid waste by a combination of Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). For the combined option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the deep well disposal capacity (Powertech, 2011).

The potential environmental impacts from fugitive dust emissions for all of the phases will be greater for the land application option because of the increased wind erosion emission levels caused by the increased amount of land disturbed. When considering the combustion emissions, the main difference between the two disposal options is the emissions from the deep well rig used to drill the Class V wells. The land application option eliminates this particular source. This distinction will only affect the construction phase because this is where all of the drill rig emissions occur. For the combustion emissions, the potential environmental impacts for the construction phase will be greater for the Class V injection well option because of the additional drill rig emissions. For the remaining three phases, the combustion emissions will be basically the same for both disposal options.

For the combined option, the air emissions associated with the development of all the Class V injection disposal wells will be supplemented with the emissions associated with the development, at some level, of the irrigation areas and increased pond capacity. Fugitive dust emissions for all four phases will include the additional contribution of the wind erosion from the increased land disturbance from the land application option. The construction phase will include the combustion emissions from the deep well drill rig. Therefore, NRC staff conclude that the environmental impacts of the combined option for the construction, operation, aquifer restoration, and decommissioning phases of the proposed Dewey-Burdock ISR Project will be greater than either the Class V deep injection well option or the land application option.

However, for each phase of the proposed project, the changes in air emissions levels will be subtle and not result in any distinctions concerning the magnitude of the environmental impacts (Table 4.7-5). NRC staff concludes this will also be the case when the impact analysis uses the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and includes the PM_{10} emissions in the CALPUFF visibility analysis.

4.14 Waste Management Impacts

As described in GEIS Section 4.4.12, environmental impacts on waste management could occur during all phases of the ISR lifecycle. The proposed project will generate radiological and nonradiological liquid and solid materials that must be handled and disposed of properly. The primary radiological materials that must be disposed are process-related liquids and process-contaminated structures, equipment, and soils, all of which are classified as byproduct material.

Before operations could begin, NRC requires an ISR facility to have an agreement in place with a licensed disposal facility to accept byproduct material. NRC will require by license condition that the disposal agreement be in place before the initiation of operations. Lack of a signed disposal agreement will be grounds for a cessation of operations until a signed agreement is obtained.

GEIS Construction Phase Summary

In GEIS Section 4.4.12.1, NRC staff concluded that waste management impacts from the construction phase of an ISR facility will be SMALL. Because construction activities will be on a relatively small scale, a low volume of construction waste will be generated. (NRC, 2009a)

Table 4.13-2. Significance of Occupational and Public Health and Safety Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

GEIS Operations Phase Summary

According to GEIS Section 2.7, byproduct material generated during the operations phase at an ISR facility will primarily be liquid consisting of process bleed (1 to 3 percent of the process flow rate). NRC staff also noted in the GEIS that byproduct material will be generated from flushing of eluant to limit impurities, resin transfer wash, filter washing, uranium precipitation process wastes (brine), and plant washdown water. Treatment and disposal methods described in the GEIS for liquid byproduct material at ISR facilities were characterized as effective at reducing the volume of material prior to disposal at an approved facility. Solid byproduct material will be decontaminated and released for other use or disposed of at approved waste disposal facilities.

NRC staff concluded in the GEIS that the waste management impact from disposal of byproduct material will be SMALL given the required preoperational disposal agreements between an applicant and a licensed byproduct material disposal site. The impact from hazardous waste disposal was expected to be SMALL because of the small volume of hazardous waste generated. The impact from disposal of nonhazardous solid waste was expected to be SMALL based on the available disposal capacity of municipal solid waste facilities. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

GEIS Section 4.4.12.3 described waste management activities that will occur during the aquifer restoration phase of an ISR project and noted that the same treatment and disposal options will be implemented as used during operations. Therefore, the waste management impacts will be similar to those during the operations phase of an ISR project. Some increase in wastewater volumes could occur, but the increase in volume will be offset by the decrease in production capacity. NRC staff concluded in the GEIS that the impact on waste management from aquifer restoration will be SMALL. (NRC, 2009a)

GEIS Decommissionig Phase Summary

GEIS Section 2.6 stated that wastes generated from decommissioning an ISR facility will be predominantly byproduct material and nonhazardous solid waste. GEIS Section 4.4.12.4 stated that decommissioning byproduct material (including contaminated facility demolition materials, process and wellfield equipment, excavated soil, and pond bottoms) will be disposed of at a licensed facility. As stated previously, to ensure that sufficient disposal capacity is available for byproduct material (including that generated by decommissioning activities), NRC requires a preoperational agreement with a licensed disposal facility to accept byproduct material for disposal. NRC staff concluded in the GEIS that because the volume of byproduct material, chemical, and solid wastes generated during decommissioning will be small, the impact on waste management will also be SMALL. (NRC, 2009a)

Environmental impacts on waste management resources during the construction, operations, aquifer restoration, and decommissioning phases of the proposed ISR project are discussed next. The environmental impacts of the proposed waste management actions on other resources are evaluated within the applicable subsections of each impact analysis in this chapter.

4.14.1 Proposed Action (Alternative 1)

Under the proposed action, the types of waste streams that could be generated are discussed in SEIS Section 2.1.1.1.6. The primary radiological materials the proposed Dewey-Burdock ISR Project will dispose of are process-related liquid effluent and process-contaminated structures, equipment, and soils, all of which are classified as byproduct material. As described in SEIS Section 2.1.1.1.6.3, the applicant has identified White Mesa for disposal of solid byproduct material. The applicant's preferred method for disposal of liquid byproduct material is by Class V injection well. If a permit cannot be obtained from EPA for Class V injection, the applicant will pursue land application of treated liquid effluent. If the capacity of either method is limited, the applicant will pursue a combination of both Class V injection and land application. The impacts on waste management from the Class V injection well option are described in Section 4.14.1.1. The impacts on waste management from the land application option and combined Class V injection and land application are described in SEIS Sections 4.14.1.2 and 4.14.1.3. Alternative wastewater disposal options, including evaporation ponds and surface water discharge, are described in SEIS Section 4.14.1.4.

4.14.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells. Potential environmental impacts on waste management from construction, operations, aquifer restoration, and decommissioning associated with the deep Class V injection well disposal option at the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.14.1.1.1 Construction Impacts

The primary wastes to be disposed of during this phase of the ISR facility lifecycle will be nonhazardous solid waste, such as building materials and piping. As discussed in SEIS Sections 2.1.1.1.6.3 and 3.13.2, the applicant has proposed to dispose of nonhazardous solid wastes at the Custer-Fall River Waste Management District landfill located at Edgemont, South Dakota, approximately 24 km [15 mi] southeast of the proposed Dewey-Burdock ISR Project site or at the Newcastle, Wyoming, landfill, approximately 64 km [40 mi] north of the proposed project site if additional capacity is needed (Powertech, 2010a). As described in SEIS Section 3.13.2, these landfills are not at or near capacity.

The proposed activities to manage construction waste generated by the proposed project are discussed in SEIS Section 2.1.1.1.6. The proposed action will annually generate a volume of 144 m_3 [188 yd_3] of nonhazardous solid waste during the construction phase (SEIS Section 2.1.1.1.6.3), which is 1 percent or less of the annual volume of waste disposed at either the Custer-Fall River Waste Management District landfill or the Newcastle landfill (SEIS

Section 3.13.2). Nonhazardous solid waste generated at the proposed annual rate for the duration of the construction phase (6 years) will account for 1 percent or less of the capacity of either landfill. Because there is available capacity and the ISR construction phase will annually generate a small volume, the NRC staff conclude the impact on waste management from the Class V injection well disposal option at the proposed project will be SMALL.

4.14.1.1.2 Operations Impacts

Liquid byproduct material generated during operations is composed of production bleed, waste brine streams from elution and precipitation, resin transfer wash, laundry water, plant washdown water, and laboratory chemicals (SEIS Section 2.1.1.1.6.2). The applicant estimates the maximum production of liquid byproduct material at any time considering concurrent uranium recovery operations and aquifer restoration activities is 746 L/min [197 gal/min] for the deep Class V disposal well option (Powertech, 2011). The applicant proposes to treat this combined liquid byproduct material stream onsite to remove radium and uranium by radium settling and ion exchange, respectively (SEIS Section 2.1.1.1.6.2). This will reduce radionuclide activities below the established NRC limits under 10 CFR Part 20, Appendix B, Table 2, Column 2 prior to injecting the material into a deep Class V disposal well (Powertech, 2011). 10 CFR Part 20, Appendix B, Table 2, Column 2 includes effluent concentration limits for natural uranium, Ra-226, Pb-210 and Th-230. As stated in Section 2.1.1.1.6.2, the applicant will have to meet applicable EPA and NRC requirements before injection in a deep Class V injection well begins. When evaluating permit applications for Class V wells, EPA considers the characteristics of the operation, the material proposed to be injected, and the surrounding environment and 2012). An EPA permit, if granted, will also prohibit hazardous waste (as defined by RCRA) from being injected. NRC will require (i) liquid byproduct material to be treated prior to injection and (ii) treatment systems to be approved, constructed, operated, and monitored to ensure release standards in 10 CFR Part 20, Subparts D and K and Appendix B are met. The applicant proposes to have 4 to 8 Class V injection wells with a capacity of 1,136 L/min [300 gal/min], sufficient to accommodate the estimated 746 L/min [197 gal/min] of liquid byproduct material generated from the proposed operation. Based on the applicant's proposal to obtain adequate disposal capacity as well as requirements to comply with EPA Class V disposal permit conditions, NRC effluent limits, and other NRC safety regulations, the NRC staff conclude that the waste management impacts from the disposal of liquid byproduct material via deep Class V injection wells during the ISR operation phase will be SMALL.

Solid byproduct material generated during operations could include maintenance and housekeeping rags and trash; packing materials; replaced components; filters; protective clothing; and solids removed from process pumps, vessels, and ponds. As discussed in SEIS Section 2.1.1.1.6.3, the applicant estimates, during the operational period and assuming combined operations and aquifer restoration, the proposed Dewey-Burdock facility will produce 22 m^3 [29 yd^3] of solid byproduct material from radium settling ponds annually from the deep Class V disposal well option (Powertech, 2011). Solid byproduct material will be stored onsite within a restricted area until sufficient volume is generated for disposal. Based on the disposal options currently available and the disposal agreement that NRC requires prior to operations (SEIS Section 2.1.1.1.6.3), the NRC staff conclude that the impacts on waste management from the disposal of solid byproduct material during the ISR operations phase will be SMALL.

Nonhazardous solid wastes generated during operations could include facility trash, septic solids, and other uncontaminated solid wastes (e.g., piping, valves, instrumentation, and equipment). Because the proposed generation rate of nonhazardous solid waste (SEIS Section 2.1.1.1.6.3) will be a small percentage of the landfill capacity (SEIS Section 3.13.2), the NRC staff conclude the impact on waste management will be SMALL.

As discussed in SEIS Section 2.1.1.1.6.3, the applicant has stated it will likely be classified as a conditionally exempt small quantity generator (CESQG). The applicant will transport its hazardous waste to a permitted hazardous waste facility for disposal (Powertech, 2009a).

Based on the type and quantity of byproduct material and waste expected to be generated and the available capacity for disposal, the NRC staff conclude the waste management activities during the ISR operations phase of the proposed Dewey-Burdock Project will have a SMALL impact on waste management resources.

4.14.1.1.3 Aquifer Restoration Impacts

For the proposed Dewey-Burdock Project, the applicant will use the same waste management systems for aquifer restoration as used during ISR operations discussed in SEIS Section 2.1.1.1.6.

Liquid byproduct material generated during aquifer restoration is composed of reverse osmosis brine (SEIS Section 2.1.1.1.6.2). The applicant proposes to manage aquifer restoration wastewater (i.e., liquid byproduct material) by treating the wastewater by reverse osmosis and reinjecting the treated water (i.e., permeate) back into the aquifer production zone undergoing restoration (see SEIS Section 2.1.1.1.4.1). The applicant will combine the contaminants removed from water with operational wastewater and transfer the combined wastewater to the radium settling ponds for further treatment prior to disposal in the deep Class V wells. As stated in SEIS Section 2.1.1.1.6.2, the applicant will have to meet applicable EPA and NRC requirements before injection in a deep Class V disposal well begins. When evaluating permit applications for Class V wells, EPA considers the characteristics of the operation, the material to be injected, and the surrounding environment and determines whether the proposed injection will endanger public health or the environment (EPA, 2012). NRC will require liquid byproduct material to be treated prior to injection and treatment systems be approved, constructed, operated, and monitored to ensure release standards in 10 CFR Part 20, Subparts D and K and Appendix B are met. The applicant proposes to have 4 to 8 Class V injection wells with a capacity of 1,136 L/min [300 gal/min], sufficient to accommodate the estimated 746 L/min [197 gal/min] of liquid byproduct material generated from the proposed operation. Based on the applicant's proposal to obtain adequate disposal capacity as well requirements to comply with EPA Class V disposal permit conditions, NRC effluent limits, and other NRC safety regulations, the NRC staff conclude that the waste management impacts from the disposal of liquid byproduct material via deep Class V injection wells during the ISR aquifer restoration phase will be SMALL.

Solid byproduct material generated during aquifer restoration could include maintenance and housekeeping rags and trash; packing materials; replaced components; filters; protective clothing; and solids removed from process pumps, vessels, and ponds. As discussed in SEIS Section 2.1.1.1.6.3, the applicant estimates, during the operational period and assuming combined operations and aquifer restoration, the proposed Dewey-Burdock facility will produce 22 m^3 [29 yd^3]of solid byproduct material from radium settling ponds annually from the deep Class V disposal well option (Powertech, 2011). Solid byproduct material will be stored onsite within a restricted area until sufficient volume is generated for disposal. Based on the disposal options currently available and the disposal agreement that NRC requires prior to operations (SEIS Section 2.1.1.1.6.3), the NRC staff conclude that the waste management impacts from the generation of byproduct material during the ISR operations phase will be SMALL.

Nonhazardous solid wastes generated during aquifer restoration could include facility trash, septic solids, and other uncontaminated solid wastes (e.g., piping, valves, instrumentation, and equipment). Because the proposed generation rate of nonhazardous solid waste (SEIS Section 2.1.1.1.6.3) will be a small percentage of the landfill capacity (SEIS Section 3.13.2), the NRC staff conclude the impact on waste management will be SMALL.

As discussed in SEIS Section 2.1.1.1.6.3, the applicant has stated it will likely be classified as a CESQG. The applicant will transport its hazardous waste to a permitted hazardous waste facility for disposal (Powertech, 2009a).

Based on the type and quantity of waste expected to be generated and the available capacity for disposal, the NRC staff conclude the waste management actions during the ISR aquifer restoration phase of the proposed project will have a SMALL impact on waste management resources.

4.14.1.1.4 Decommissioning Impacts

The anticipated decommissioning activities occurring at the proposed Dewey-Burdock ISR Project site will be comparable to those described in GEIS Section 2.6. The applicant proposed to conduct radiological surveys of decommissioned facilities and equipment and classify materials in accordance with the applicable disposition of the materials (Powertech, 2009b, 2011), including decontamination, recycling and reuse, disposal as byproduct material at a licensed facility, or disposal as nonhazardous solid waste at a municipal solid waste landfill (Powertech, 2009b, 2011).

As discussed in SEIS Section 2.1.1.1.6.3, the applicant's estimate for byproduct material generated from decommissioning the plant facilities and all wellfields (over a planned 2-year period) is 1,419 m^3 [1,856 yd^3] for the deep Class V injection well disposal option (Powertech, 2011). As discussed in SEIS Section 2.1.1.1.6.3, the applicant does not have a disposal agreement in place with a licensed site to accept solid byproduct material, and as discussed in SEIS Section 4.14.1.1.2, NRC will require that the applicant enter into a written agreement with a disposal site to ensure adequate capacity for byproduct material disposal. The applicant has proposed to pursue an agreement with the White Mesa site in Blanding, Utah, for disposal of solid byproduct material (SEIS Section 3.13.2). Based on the disposal options currently available for byproduct material and the disposal agreement which NRC will require by license condition prior to operations, the NRC staff conclude that the impact on waste management from the generation of byproduct material during decommissioning will be SMALL.

The applicant's estimate of the total volume of nonhazardous solid waste that will be generated from decommissioning is 10,427 m^3 [13,638 yd^3] for the deep Class V injection well disposal option (Powertech, 2011). From this estimate, the NRC staff derived an annual nonhazardous solid waste generation of 5,213 m^3 [6,819 yd^3] from decommissioning by dividing the applicant's total estimate by 2 (the applicant's proposed decommissioning period in years). This estimated solid waste volume is greater than what was analyzed in the GEIS {715 m^3 [935 yd^3]} and thus not bounded by the impact assessment described in the GEIS; therefore, the NRC staff considered additional site-specific information to evaluate impacts.

Although permitted landfill disposal capacities of the Custer-Fall River Waste Management District landfill and the Newcastle landfill are currently available (SEIS Section 3.13.2), considering the proposed project duration and limited future disposal capacity, the NRC staff evaluated the estimated landfill capacities and demand at the time of decommissioning. Based on the current operational life of 12 years (SEIS Section 3.13.2), the Newcastle landfill will not be open to accept waste at the planned time of decommissioning (15 and 16 years after the start of construction; Figure 2.1-1) unless the landfill capacity is expanded. The Custer-Fall River landfill, with an estimated operational life of 17 years after midyear 2012, will still be in operation at the time of decommissioning if project construction started in 2013; therefore, this landfill was evaluated in more detail. NRC staff projections suggest the remaining capacity of the Custer-Fall River landfill at the time of proposed decommissioning will be insufficient to accommodate all decommissioning nonhazardous solid waste and serve the regional annual demand for disposal capacity unless existing landfill capacity and operations are expanded. Furthermore, the NRC staff estimate the additional demand for capacity will consume the remaining landfill capacity at a faster rate with the landfill reaching full capacity approximately 1 year earlier than current projections. The NRC staff's projections supporting these conclusions are detailed in the following paragraphs.

The NRC staff's landfill capacity analysis calculated the total disposal demand from mid-year 2012 through the end of the proposed decommissioning period and compared it with the reported remaining landfill capacity as of mid-year 2012. NRC staff used this comparison of projected demand and capacity to evaluate whether sufficient capacity will be available to dispose of the additional waste from the proposed project. The total disposal demand of 148,079 t [163,229 T] was based on the sum of the regional disposal demand[1] and the project disposal demand[2] from mid-2012 through the end of the proposed decommissioning period in 2028. The projected demand exceeds the available capacity of 139,619 t [154,000 T][3] by 8,372 t [9,229 T].[4]

The staff also evaluated the difference in the projected time the landfill will reach full capacity with and without disposal of waste from the proposed Dewey-Burdock ISR Project. The purpose of this analysis was to evaluate the impact of the additional disposal demand on the projected operational life of the landfill. The NRC staff calculated when the landfill will reach full capacity with the additional disposal of proposed project waste by first calculating the available landfill capacity at the end of 2027 after 1 year of decommissioning waste disposal and 15.5 years of post mid-2012 regional waste disposal.[5] Next, the NRC staff derived a combined monthly disposal demand[6] for year 2028 from the projected disposal rates for decommissioning waste and regional waste. At the combined monthly disposal demand, the projected year 2028 remaining capacity of 6,473 t [7,136 T] will be depleted within the first half of 2028.[7] For comparison, the projected operational life of the landfill without disposal of waste from the proposed action (SEIS Section 3.13.2) is 17 years beyond mid-2012 or mid-year 2029. Therefore, the analysis suggests disposal of waste from the proposed Dewey Burdock ISR Project will cause the landfill to reach full capacity 1 year earlier than expected if the proposed decommissioning was executed on schedule and regional disposal demand continued at the current rate.

The potential for future expansion of capacity is being considered at both landfills (AET, Inc., 2011; SDDENR, 2010); however, specific long-term actions remain uncertain. If one of these landfills does not expand capacity in the future, the applicant will have to dispose of waste elsewhere. Anothermore distant and higher capacity landfill serving Rapid City is projected to be operational until 2050 (HDR Engineering Inc., 2010). Therefore, the staff consider regional capacity will be available during the period of decommissioning if local capacity is limited or otherwise unavailable.

Based on the preceding capacity analysis, the NRC staff conclude that the potential impacts on waste management resources will vary depending on the long-term status of the existing local landfill resources. If local landfill capacity is not expanded prior to the proposed decommissioning period, the staff conclude that there will be no impacts to the Newcastle landfill because it will not be open to accept waste at the planned time of decommissioning and the proposed Dewey-Burdock ISR Project will not be able to dispose waste at that location. In turn, impacts to the Custer-Fall River landfill will be MODERATE because the increased demand for capacity will more rapidly consume the waste management resources during the last years of its projected operational life. Any waste disposed at the Rapid City landfill will have SMALL impacts based on the projected operational life and available capacity. Alternatively, if the local landfill capacity is expanded prior to the proposed project decommissioning phase, the impacts on the available capacity of the expanded landfill (Newcastle or Custer-Fall River) will be SMALL.

The applicant estimates the volume of hazardous waste generated from decommissioning activities will be less than 91 kg [200 lb] (Powertech, 2009b). The hazardous waste streams from decommissioning will be similar to the waste streams generated during the ISR construction phase and could include used oil, batteries, and cleaning solvents. The applicant will have in place a hazardous material program that complies with applicable EPA and SDDENR requirements for its handling, storage, and disposal at approved facilities. Because the volume of hazardous wastes generated by the proposed action will be small and the waste will be handled, stored, and disposed of in accordance with applicable regulations, the NRC staff conclude the impacts on waste management will be SMALL.

In summary, NRC staff conclude the impacts to waste management resources during the decommissioning phase of the proposed project for the deep Class V injection well disposal option will be SMALL for all materials except nonhazardous solid waste, which will be SMALL to MODERATE depending on the long-term status of the existing local landfill resources. Based on the type and quantity of waste expected to be generated and the available capacity for disposal, waste management actions during the decommissioning phase will have a SMALL impact on waste management resources for byproduct material and hazardous waste and a SMALL to MODERATE impact for nonhazardous solid waste.

4.14.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not be obtained from EPA or the capacity of the Class V wells is insufficient, the applicant proposes to dispose of liquid byproduct material generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). The locations of land application areas for this disposal option are shown in Figure 2.1-12. Potential environmental impacts on waste management resources from construction, operations, aquifer restoration, and decommissioning associated with the land application disposal option are discussed in the following sections.

4.14.1.2.1 Construction Impacts

The primary wastes to be disposed of during this phase of the ISR facility lifecycle will be nonhazardous solid waste, such as building materials and piping. As discussed in SEIS Sections 2.1.1.1.6.3 and 3.13.2, the applicant has proposed to dispose of nonhazardous solid wastes at the Custer-Fall River Waste Management District landfill located at Edgemont, South Dakota, approximately 24 km [15 mi] southeast of the proposed Dewey-Burdock Project site or at the Newcastle, Wyoming, landfill, approximately 64 km [40 mi] north of the proposed Dewey-Burdock Project site if additional capacity is needed (Powertech, 2010a). As described in SEIS Section 3.13.2, these landfills are not at or near capacity.

The proposed activities to manage construction waste generated by the proposed project are discussed in SEIS Section 2.1.1.1.6. The proposed action will annually generate a volume of 144 m^3 [188 yd^3] of nonhazardous solid waste during the construction phase (SEIS Section 2.1.1.1.6.3), which is 1 percent or less of the volume of waste disposed at either the Custer-Fall River Waste Management District landfill or the Newcastle landfill (SEIS Section 3.13.2). Nonhazardous solid waste generated at the proposed annual rate for the duration of the construction phase (6 years) will account for 1 percent or less of the capacity of either landfill. Because there is available capacity and the ISR construction phase will annually generate a small volume, the NRC staff conclude the impact on waste management from the land application disposal option at the proposed project will be SMALL.

4.14.1.2.2 Operations Impacts

Liquid byproduct material generated during operations is composed of production bleed, waste brine streams from elution and precipitation, resin transfer wash, laundry water, plant washdown water, and laboratory chemicals (SEIS Section 2.1.1.1.6.2). The applicant estimates the maximum production of liquid byproduct material at any time, considering concurrent uranium recovery operations and aquifer restoration activities, is 2,080 L/min [547 gal/min] for the land application option (Powertech, 2011). The applicant proposes to treat this combined liquid byproduct material stream onsite using ion exchange and radium settling prior to land application. The applicant proposes to treat the liquid waste (SEIS Section 2.1.1.1.6.2) to reduce radionuclide activities below the established NRC limits under 10 CFR Part 20, Appendix B, Table 2, Column 2 (Powertech, 2011) for discharge of radionuclides to the environment. 10 CFR Part 20, Appendix B, Table 2, Column 2 includes effluent concentration limits for natural uranium, Ra-226, Pb-210 and Th-230. As stated in SEIS Section 2.1.1.1.6.2, the land application will be carried out under a GDP approved by SDDENR (Powertech, 2012c). In accordance with permit program objectives, the applicant's proposed land application operations will have to meet applicable state groundwater quality standards. NRC will require

(i) liquid byproduct material be treated prior to injection and (ii) treatment systems be approved, constructed, operated, and monitored to ensure release standards in 10 CFR Part 20, Subparts D and K and Appendix B are met. While land application capacity varies throughout the year, the applicant estimates that each land application area will be able to dispose of 1,173 Lpm [310 gpm] (Powertech, 2012c). The applicant proposes two land application areas, which will provide 2,347 Lpm [620 gpm] of capacity. The applicant's proposed disposal capacity is sufficient to accommodate the proposed maximum generation rate of liquid byproduct material. Based on the applicant's proposal to obtain adequate disposal capacity and comply with state groundwater quality standards, NRC effluent limits, and other NRC safety regulations, the NRC staff conclude that the waste management impacts from the disposal of liquid byproduct material via land application during the ISR operation phase will be SMALL.

Solid byproduct material generated during operations could include maintenance and housekeeping rags and trash; packing materials; replaced components; filters; protective clothing; and solids removed from process pumps, vessels, and ponds. As discussed in SEIS Section 2.1.1.1.6.3, the applicant estimates, during the operational period and assuming combined operations and aquifer restoration, the proposed Dewey-Burdock facility will produce 50 m^3 [66 yd^3] of solid byproduct material from the land application option (Powertech, 2011). Solid byproduct material will be stored onsite within a restricted area until sufficient volume is generated for disposal. Based on the disposal options currently available and the disposal agreement that NRC requires prior to operations (SEIS Section 2.1.1.1.6.3), the NRC staff conclude that the impacts on waste management from the disposal of solid byproduct material under the land application option during the ISR operations phase will be SMALL.

Nonhazardous solid wastes generated during operations could include facility trash, septic solids, and other uncontaminated solid wastes (e.g., piping, valves, instrumentation, and equipment). Because the proposed generation rate of nonhazardous solid waste (SEIS Section 2.1.1.1.6.3) will be a small percentage of the landfill capacity (SEIS Section 3.13.2), the NRC staff conclude the impact on waste management will be SMALL.

As discussed in SEIS Section 2.1.1.1.6.3, the applicant has stated it will likely be classified as a CESQG. The applicant will transport its hazardous waste to a permitted hazardous waste facility for disposal (Powertech, 2009a).

Based on the type and quantity of byproduct material and waste expected to be generated and the available capacity for disposal, the NRC staff conclude the waste management activities during the ISR operations phase of the proposed project will have a SMALL impact on waste management resources.

4.14.1.2.3 Aquifer Restoration Impacts

For the proposed Dewey-Burdock ISR Project, the applicant will use the same waste management systems for aquifer restoration as used during ISR operations discussed in SEIS Section 2.1.1.1.6.

Liquid byproduct material generated during aquifer restoration is composed of produced water from the ore zone aquifer (Powertech, 2009b). The applicant estimates the maximum production of liquid byproduct material at any time, considering concurrent uranium recovery operations and aquifer restoration activities, is 2,080 L/min [547 gal/min] for the land application option (Powertech, 2011). The applicant proposes to manage aquifer restoration wastewater (i.e., liquid byproduct material) by treating the wastewater onsite by ion exchange and radium settling prior to land application (SEIS Section 2.1.1.1.6.2). As stated in Section 2.1.1.1.6.2, the land application will be carried out under a GDP approved by SDDENR (Powertech, 2012c). In accordance with permit program objectives, the applicant's proposed land application operations will have to meet applicable state groundwater quality standards. NRC will require liquid byproduct material be treated prior to injection and treatment systems be approved, constructed, operated, and monitored to ensure release standards in 10 CFR Part 20, Subparts D and K and Appendix B are met. While land application capacity varies throughout the year, the applicant estimates that each land application area will be able to dispose of 1,173 Lpm [310 gpm] (Powertech, 2012c). The applicant proposes 2 land application areas, which will provide 2,347 Lpm [620 gpm] of capacity. The applicant's proposed disposal capacity is sufficient to accommodate the proposed maximum generation rate of liquid byproduct material. Based on the applicant's proposal to obtain adequate disposal capacity and comply with state groundwater quality standards, NRC effluent limits, and other NRC safety regulations, the staff conclude that the waste management impacts from the disposal of liquid byproduct material via land application during the ISR aquifer restoration phase will be SMALL.

Solid byproduct material generated during aquifer restoration could include maintenance and housekeeping rags and trash; packing materials; replaced components; filters; protective clothing; and solids removed from process pumps, vessels, and ponds. As discussed in SEIS Section 2.1.1.1.6.3, the applicant estimates, during the operational period and assuming combined operations and aquifer restoration, the proposed Dewey-Burdock facility will produce 50 m^3 [66 yd^3] of solid byproduct material from the land application option (Powertech, 2011). Solid byproduct material will be stored onsite within a restricted area until sufficient volume is generated for disposal. Based on the disposal options currently available and the disposal agreement that NRC requires prior to operations (SEIS Section 2.1.1.1.6.3), the NRC staff conclude that the waste management impacts from the generation of byproduct material during the ISR operations phase will be SMALL.

Nonhazardous solid wastes generated during aquifer restoration could include facility trash, septic solids, and other uncontaminated solid wastes (e.g., piping, valves, instrumentation, and equipment). Because the proposed generation rate of nonhazardous solid waste (SEIS Section 2.1.1.1.6.3) will be a small percentage of the landfill capacity (SEIS Section 3.13.2), the NRC staff conclude the impact on waste management will be SMALL.

As discussed in SEIS Section 2.1.1.1.6.3, the applicant has stated it will likely be classified as a CESQG. The applicant will transport its hazardous waste to a permitted hazardous waste facility for disposal (Powertech, 2009a).

Based on the type and quantity of waste expected to be generated and the available capacity for disposal, the NRC staff conclude the waste management actions during the ISR aquifer restoration phase of the proposed project will have a SMALL impact on waste management resources.

4.14.1.2.4 Decommissioning Impacts

The anticipated decommissioning activities occurring at the proposed Dewey-Burdock ISR Project site will be comparable to those described in GEIS Section 2.6. The applicant proposed to conduct radiological surveys of decommissioned facilities and equipment and classify materials in accordance with the applicable disposition of the materials (Powertech, 2009b, 2011), including decontamination, recycling and reuse, disposal as byproduct material at a licensed facility, or disposal as nonhazardous solid waste at a municipal solid waste landfill (Powertech, 2009b, 2011).

As discussed in SEIS Section 2.1.1.1.6.3, the applicant's estimate for byproduct material generated from decommissioning the plant facilities and all wellfields (over a planned 2-year period) is 1,580 m^3 [2,067 yd^3] for the land application option (Powertech, 2011). As discussed in SEIS Section 2.1.1.1.6.3, the applicant does not have a disposal agreement in place with a licensed site to accept solid byproduct material, and as discussed in SEIS Section 4.14.1.1.2, NRC will require that the applicant enter into a written agreement with a disposal site to ensure adequate capacity for byproduct material disposal. The applicant has proposed to pursue an agreement with the White Mesa site in Blanding, Utah, for disposal of solid byproduct material (SEIS Section 3.13.2). Based on the disposal options currently available for byproduct material and the disposal agreement, which NRC will require by license condition prior to operations, the NRC staff conclude that the impact on waste management from the generation of byproduct material under the land application option during decommissioning will be SMALL.

The applicant's estimate of the total volume of nonhazardous solid waste that will be generated from decommissioning is 12,496 m^3 [16,344 yd^3] for the land application option (Powertech, 2011). From this estimate, the NRC staff derived an annual nonhazardous solid waste generation of 6,248 m^3 [8,172 yd^3] from decommissioning by dividing the applicant's total estimate by 2 (the applicant's proposed decommissioning period in years). This estimated solid waste volume is greater than what was analyzed in the GEIS {715 m^3 [935 yd^3]} and thus not bounded by the GEIS impact assessment; therefore, the NRC staff considered additional site-specific information to evaluate impacts.

Although permitted landfill disposal capacities at the Custer-Fall River Waste Management District landfill and the Newcastle landfill are currently available (SEIS Section 3.13.2), considering the proposed project duration and limited future disposal capacity, the NRC staff evaluated the estimated landfill capacities and demand at the time of decommissioning. Based on the current operational life of 12 years (SEIS Section 3.13.2), the Newcastle landfill will not be open to accept waste at the planned time of decommissioning (15 and 16 years after the start of construction; SEIS Figure 2.1-1) unless the landfill capacity was expanded. The Custer-Fall River landfill, with an estimated operational life of 17 years after mid-year 2012, will still be in operation at the time of decommissioning if project construction started in 2013; Section 106 consultation between NRC, SD SHPO, BLM, tribal representatives, and the applicant therefore, this landfill was evaluated in more detail. NRC staff projections suggest the remaining capacity of the Custer-Fall River landfill at the time of proposed decommissioning will be insufficient to accommodate all decommissioning nonhazardous solid waste and serve the regional annual demand for disposal capacity unless existing landfill capacity and operations were expanded. Furthermore, the NRC staff estimate the additional demand for capacity will consume the remaining landfill capacity at a faster rate with the landfill reaching full capacity approximately 1 year earlier than current projections. The NRC staff's projections supporting these conclusions are detailed in the following paragraphs.

The NRC staff's landfill capacity analysis calculated the total disposal demand from mid-year 2012 through the end of the proposed decommissioning period and compared it with the reported remaining landfill capacity as of mid-year 2012. NRC staff used this comparison of projected demand and capacity to evaluate whether sufficient capacity will be available to dispose of the additional waste from the proposed Dewey-Burdock ISR Project. The total disposal demand of 150,730 t [166,152 T] was based on the sum of the regional disposal demand[8] and the project disposal demand[9] from mid-2012 through the end of the proposed decommissioning period in 2028. The projected demand exceeds the available capacity of 139,619 t [154,000 T][10] by 11,024 t [12,152 T].[11]

The staff also evaluated the difference in the projected time the landfill will reach full capacity with and without disposal of waste from the proposed Dewey-Burdock ISR Project. The purpose of this analysis was to evaluate the impact of the additional disposal demand on the projected operational life of the landfill. The NRC staff calculated when the landfill will reach full capacity with the additional disposal of proposed project waste by first calculating the available landfill capacity at the end of 2027 after 1 year of decommissioning waste disposal and 15.5 years of post mid-2012 regional waste disposal.[12] Next, the NRC staff derived a combined monthly disposal demand[13] for year 2028 from the projected disposal rates for decommissioning waste and regional waste. At the combined monthly disposal demand the projected year 2028 remaining capacity of 5,147 t [5,674 T] will be depleted within the first half of 2028.[14] For comparison, the projected operational life of the landfill without disposal of waste from the proposed action (SEIS Section 3.13.2) is 17 years beyond mid-2012 or mid-year 2029. Therefore, the analysis suggests disposal of waste from the proposed Dewey-Burdock ISR Project will cause the Custer-Fall River landfill to reach full capacity 1 year earlier than expected if the proposed decommissioning was executed on schedule and regional disposal demand

continued at the current rate.
The potential for future expansion of capacity is being considered at both landfills (AET, Inc., 2011; SDDENR, 2010); however, specific long term actions remain uncertain. If one of these landfills does not expand capacity in the future, the applicant will have to dispose of waste elsewhere. Another more distant and higher capacity landfill serving Rapid City is projected to be operational until 2050 (HDR Engineering Inc., 2010). Therefore, the staff consider regional capacity will be available during the period of decommissioning if local capacity is limited or otherwise unavailable.
Based on the preceding capacity analysis, the NRC staff conclude that the potential impacts on waste management resources will vary depending on the long-term status of the existing local landfill resources. If local landfill capacity is not expanded prior to the proposed decommissioning period, the NRC staff conclude that there will be no impacts to the Newcastle landfill because it will not be open to accept waste at the planned time of decommissioning and the proposed Dewey-Burdock IRS Project will not be able to dispose waste at that location. In turn, impacts to the Custer-Fall River landfill will be MODERATE because the increased demand for capacity will more rapidly consume the waste management resources during the last years of its projected operational life. Any waste disposed at the Rapid City landfill will have SMALL impacts based on the projected operational life and available capacity. Alternatively, if the local landfill capacity is expanded prior to the proposed project decommissioning phase, the impacts on the available capacity of the expanded landfill (Newcastle or Custer-Fall River) will be SMALL.
The applicant estimates the volume of hazardous waste generated from decommissioning activities will be less than 91 kg [200 lb] (Powertech, 2009b). The hazardous waste streams from decommissioning will be similar to the waste streams generated during the ISR construction phase and could include used oil, batteries, and cleaning solvents. The applicant will have in place a hazardous material program that complies with applicable EPA and SDDENR requirements for its handling, storage, and disposal at approved facilities. Because the volume of hazardous wastes generated by the proposed action will be small and the waste will be handled, stored, and disposed of in accordance with applicable regulations; the NRC staff conclude the impacts on waste management will be SMALL.
In summary, NRC staff conclude the impacts to waste management resources during the decommissioning phase of the proposed project for the land application liquid waste disposal option will be SMALL for all materials except nonhazardous solid waste, which will be SMALL to MODERATE depending on the long-term status of the existing local landfill resources. Based on the type and quantity of waste expected to be generated and the available capacity for disposal, waste management actions during the decommissioning phase will have a SMALL impact on waste management resources for byproduct material and hazardous waste and a SMALL to MODERATE impact for nonhazardous solid waste.

4.14.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the proposed Dewey-Burdock ISR Project, the applicant has proposed to dispose of liquid waste by a combination of deep well disposal using Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3).
For the combined deep Class V injection well and land application disposal option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the deep Class V injection well disposal capacity (Powertech, 2011). The land application option will require the construction and operation of irrigation areas and increased pond capacity for storage of liquid wastes during nonirrigation periods (see SEIS Section 2.1.1.1.2.4.2), whereas the deep Class V injection well disposal option will require the construction and operation of four to eight deep disposal wells (see SEIS Section 2.1.1.1.2.4.1).

The relative volumes of byproduct material generated by the two disposal options differ during operations, aquifer restoration, and decommissioning phases with the land application option generating the larger amount of material for offsite disposal in each phase. The relative volumes of nonhazardous solid waste generated by the two disposal options differ during the decommissioning phase. The significance of these differences with regard to environmental impacts is low and does not change the impact conclusions for each disposal option. Therefore, the environmental impacts on waste management resources associated with the land application option will be the same for the deep Class V injection well disposal option for all phases of the ISR process. Furthermore, only a portion of land application facilities and infrastructure (e.g., irrigation areas and storage ponds) will be constructed, operated, and decommissioned for the combined disposal option. Therefore, the significance of environmental impacts on waste management resources for the combined disposal option will be less than for the land application option alone. Based on this reasoning, NRC staff conclude that the environmental impacts on waste management of the combined deep Class V injection well and land application disposal option for each phase of the proposed Dewey-Burdock ISR Project will be bounded by the significance of environmental land use impacts of the deep Class V injection well disposal option and the land application disposal option as summarized in Table 4.14-1.

4.14.1.4 Alternative Wastewater Disposal Options

If the applicant does not obtain a UIC Class V injection well permit or the necessary permits for land application, it will have to identify another wastewater disposal option. This section evaluates the environmental impacts from implementing the alternate wastewater disposal options identified in SEIS Section 2.1.1.2, namely evaporation ponds and surface water discharge. These alternative wastewater disposal options will involve treatment of the wastewater resulting in the generation of solid waste, which also must be managed.

In the alternative wastewater disposal options considered in the following sections, the footprint of the disposal system would be similar to or increase as compared to disposal via a UIC Class V injection well (the applicant's preferred waste disposal option) (SEIS Section 4.14.1.1) and be similar to or decrease as compared to the applicant's land application option or combination of both. Increasing the size of the proposed facility would lead to more land disturbance and a heavier use of construction equipment, with an anticipated increase in potential impacts to resource areas, such as ecological and wetland systems, cultural and historical resources, and nonradiological air quality. The applicant would have to amend its license application to select one of these alternative wastewater disposal options. NRC staff would perform an additional environmental and safety review before deciding whether to grant or deny the license amendment request for the new wastewater disposal option. The applicant would survey the areas to be affected prior to construction, and the applicant and NRC staff would consult with agencies such as the SD SHPO, SDGFP, and FWS, as appropriate. Mitigation measures, such as avoidance of sensitive areas or documentation of cultural resources, would be discussed and implemented, as appropriate, as part of these consultations. If mitigation measures were implemented, the estimated impacts would be SMALL.

5.6.10 Air Quality

This section describes the potential non-radiological air quality impacts. Potential radiological impacts are described in Section 5.6.9.

5.6.10.1 Potential Air Quality Impacts

Potential air quality impacts during construction activities will include emissions from heavy equipment, vehicles, and drill rigs; dust from traffic; and dust from surface-disturbing activities. Most dust will be generated from vehicular traffic on the unpaved roads; therefore, speed limits will be imposed for employee vehicles and transport trucks in order to mitigate the amount of dust generated from unpaved roads. Temporarily disturbed areas also will be reseeded and restored as soon as possible to minimize erosion of soil and fugitive dust emissions.

During operation, non-radiological gaseous emissions will include fugitive dust, vehicle combustion emissions, and stationary source emissions, including propane heating emissions and carbon dioxide released during uranium processing in the CPP. Fugitive dust will be lower during operation than construction due to decreased surface disturbing activities.

Powertech (USA) has prepared a detailed emissions inventory for all project phases (construction, operation, aquifer restoration, and reclamation/decommissioning). The emissions inventory has been provided to NRC and will be provided to the DENR Air Program. Based on the emissions inventory, stationary source emissions of criteria pollutants are not expected to meet the minor or major source thresholds for air quality construction permitting. This includes NOx, PM10, CO, SO2, and hazardous air pollutants (which exclude CO2).

5.6.10.2 Mitigation of Potential Air Quality Impacts

Mitigation measures for potential air quality impacts, including potential impacts to areas defined as critical air quality resources by SDCL 45-6B-92(8) such as nearby residences and recreation areas, will include but will not be limited to the following:

• Reduce fugitive dust emissions via standard dust control measures (e.g., water application on roads and disturbed areas and implementation of speed limits).

• Encourage employee carpooling.

• Reduce fugitive dust by coordinating dust-producing activities during construction and minimizing disturbed areas.

• Promptly reclaiming and reseeding disturbed areas.

• Maintain vehicles to meet applicable EPA emission standards.

• Obtain a South Dakota air quality permit, if required. Powertech (USA) has submitted a permit application to the DENR Air Quality Program requesting an exemption from South Dakota air permitting as a minor source of emissions. The permit application includes a detailed emissions inventory that demonstrates that total stationary sources of emissions of criteria pollutants will be well below the 25 tons/year threshold.

• Maintain emission control systems to ensure that the annual TEDE is within the 10 CFR Part 20 public dose limit (refer to Sections 5.6.9.1 and 5.6.9.2).

• Model potential air quality impacts. Powertech (USA) currently is performing detailed ambient air quality modeling that is being coordinated with NRC and EPA. The modeling will evaluate the potential impacts of emissions from the Dewey-Burdock Project on ambient air quality to nearby residences and potential near-field impacts within 50 km of the proposed permit area (including Jewel Cave National Monument). In addition, the modeling specifically will address potential impacts on air quality related values (AQRVs) at the Wind Cave National Park, the nearest Class I area. The modeling results will be publicly available and will be submitted to DENR upon request.

5.6.11 Ecological Resources

5.6.11.1 Potential Ecological Resources Impacts

The following section discusses the potential ecological impacts of operations at the project site.

5.6.11.1.1 Vegetation

Well field and production facilities will be constructed within Big Sagebrush Shrubland, Greasewood Shrubland, Ponderosa Pine Woodland, and Upland Grassland vegetation communities. Potential direct impacts include the short-term loss of vegetation (modification of structure, species composition, and aerial extent of cover types). Potential indirect impacts include the short-term and long-term increased potential for non-native species invasion, establishment, and expansion; exposure of soils to accelerated erosion; shifts in species composition or changes in vegetative density; reduction of wildlife habitat; reduction in livestock forage; and changes in visual aesthetics.

Construction activities and increased soil disturbance could stimulate the introduction and spread of undesirable and invasive, non-native species within the permit area. Non-native species invasion and establishment has become an increasingly important result of previous and current disturbance in South Dakota. No threatened or endangered vegetation species were observed within the permit area; therefore, no impacts are anticipated.

Potential impacts to riparian areas and wetlands will be very limited. Section 5.6.4.1.3 describes mitigation of potential impacts to wetlands, including constructing facilities away from Beaver Creek and Pass Creek and conducting construction, operation, or reclamation activities that have the potential to disturb jurisdictional wetlands in accordance with appropriate USACE permits. Riparian areas occur primarily in a relatively narrow corridor along Pass Creek (refer to the mapped Cottonwood Gallery on Plate 3.7-1). A comparison between Plates 3.7-1 and 3.5-1 shows that the extents of the Cottonwood Gallery are generally within the 100-year flood inundation boundary along Pass Creek. Section 5.6.4.1.2 describes how Powertech (USA) will construct facilities outside of the flood inundation boundaries with few exceptions such as individual wells and pipelines. This is supported by Plate 3.5-1, which shows that facilities have been designed to avoid the Pass Creek flood inundation area including land application areas and well fields.

5.6.11.1.2 Wildlife and Fisheries

ISR uranium production is unlike open-pit mining, since it uses less intrusive extraction methods that have less impact on the surrounding area.

Despite the relatively limited surface disturbance, there are potential direct and indirect impacts on local wildlife populations. These potential impacts are both short-term (until successful reclamation is achieved) and long-term (persisting beyond successful completion of reclamation). However, the latter category is not expected to be significant due to the relatively limited habitat disturbance. The potential direct impacts on wildlife include: injuries and mortalities caused by collisions with project-related traffic or habitat removal actions such as topsoil stripping, particularly for smaller species with limited mobility such as some rodents and herptiles; and restrictions on wildlife movement due to construction of fences. The likelihood for the impacts resulting in injury or mortality is greatest during the construction phase due to increased levels of traffic and physical disturbance during that period. Overall traffic will increase from current levels and will persist during operations, but should occur at a reduced and possibly more predictable level than during the construction phase. Speed limits will be enforced during all construction and maintenance operations to reduce impacts to wildlife throughout the year, but particularly during the breeding season.

Most of the habitat disturbance associated with the ISR facilities will consist of scattered, confined drill sites for well fields that will not result in large expanses of habitat being dramatically transformed from its original character, as would be the case with open-pit mining. Therefore, most potential indirect impacts relate to the displacement of wildlife due to increased noise, traffic, or other disturbances associated with the development and operation of the project, as well as from small reductions in existing or potential cover and forage due to habitat alteration, fragmentation, or loss. Indirect impacts typically persist longer than direct impacts. However, because ISR results in fewer large-scale habitat alterations, there will not be a need for reclamation actions that result in dramatic differences between pre-mining and post-mining vegetative communities.

Multiple site visits and targeted surveys conducted for the baseline surveys, combined with existing agency databases that encompass the permit area and input from local residents, indicate that the permit area and surrounding vicinity are occupied by a wide variety of common wildlife and fish species, with only a few species of particular concern occurring in the area. The most notable species of interest is the bald eagle, which is still considered threatened at the state level. Bald eagle winter roost sites and a successful nest site were documented within the permit area during surveys conducted in 2007 and 2008. Two other species tracked by the SDNHP were confirmed or suspected to have nested in the permit area in 2008, the long-eared owl and long-billed curlew. Eight additional SDNHP species were documented in or near the permit area during baseline surveys. However, those observations consisted of birds flying over the area, or sightings made in the surrounding perimeter. No grouse leks have been recorded within 6 miles of the permit area during agency or project-specific surveys completed in recent years.

Suitable habitat (trees and native uplands) for all three nesting SDNHP species occurs in the permit area. However, the limited disturbance of ISR and the presence of apparently suitable (due to low density of other nesting individuals) alternate nesting habitat throughout the permit area and surrounding area combine to minimizing the potential for both direct and indirect impacts for those species and others that require similar habitats. One of those species, the long-eared owl, nested within 75 meters, but largely beyond view of, an existing gravel county road, suggesting the pair has at least some level of tolerance for vehicular traffic near active nest sites. Other wildlife species of concern, such as other nesting raptors, that occur in the area also may experience direct and/or indirect impacts from increased travel and noise in the area during project construction and operation. However, the presence of potential alternate nesting and foraging habitat in the immediate vicinity, the mobility of those species, and the location of most nest sites relative to planned disturbance combine to reduce impacts to most nesting SDNHP birds as well as other species of interest.

Some vegetative communities present currently in the permit area can be difficult to reestablish through artificial plantings, and natural seeding of those species would likely take many years. However, the current habitat of greatest concern (Big Sagebrush Shrubland) occurs only in scattered stands that are relatively small and widely-spread across the permit area. Results from lek searches, breeding bird surveys, and small mammal trapping, as well as regular site visits in all seasons, strongly suggest that sage obligates other than pronghorn occur in limited numbers in the permit area, if at all. The vegetative communities that indicated the strongest associations between terrestrial species and habitats during baseline surveys (Cottonwood Gallery and Ponderosa Pine) will not be significantly impacted by construction or operation of the proposed project. It is possible that the potential implementation of land application systems may enhance nesting, brood-rearing, and/or foraging habitat for some species. Consequently, although individual animals associated with some specific habitats could be impacted by the proposed ISR operations, the small percentage of projected surface disturbance within the permit area relative to its overall size, and the low density of nesting efforts relative to habitat presence in that area, suggest that their populations as a whole will experience minimal impacts from the project. Advanced planning of construction siting and activities in concert with continued monitoring can reduce impacts further and assist with the development of mitigation options, if necessary. Potential impacts to these species and others are discussed in greater detail in the following sections.

5.6.11.1.3 Big Game

Big game could be displaced from portions of the permit area to adjacent areas, particularly during construction of the well fields and facilities, when disturbance activities will be greatest. Disturbance levels will decrease during actual ISR operations, and will consist primarily of vehicular traffic on new and existing improved and unimproved (two-track) roads throughout the permit area. Similar disturbance already is present in the area due to existing ISR exploration, ranching, and railroad operations. Pronghorn antelope would be most affected, as they are most prevalent in the area. However, no areas classified as crucial pronghorn habitat occur on or within several miles of the permit area, and this species is not as common in the general area as elsewhere within the region due to the limited presence of sagebrush in the area. Mule deer would not be impacted substantially given their somewhat limited use of these lands, the paucity of winter forage and security cover, and the availability of suitable habitat in adjacent areas.

SDGF&P does not consider the permit area to be within the crucial habitat range of any big game species. A letter from SDGF&P confirming this statement and updating the status of big game species as of May 2010 is provided in Appendix 5.6-B. Sightings of those species in that vicinity are often seasonal and less common.

5.6.11.1.4 Other Mammals

Medium-sized mammals (such as lagomorphs, canids, and badgers) may be displaced temporarily to other habitats during the initial construction activities. Direct losses of some small mammal species (e.g., voles, ground squirrels, mice) may be higher than for other wildlife due to their more limited mobility and likelihood that they would retreat into burrows when disturbed, and thus be potentially impacted by topsoil scraping or staging activities. However, given the limited area expected to be disturbed by the project, such impacts would not be expected to result in major changes or reductions in mammalian populations for small or medium-sized animals. This is supported by NRC guidance in NUREG-1910 (NRC, 2009), which states, "Displaced species may re-colonize in adjacent, undisturbed areas or return to their previously occupied habitats after construction ends and suitable habitats are reestablished." Few bats were recorded in the area despite extra efforts to observe them during the baseline surveys. Those that were seen were near water bodies near treed habitats, which are not currently scheduled for disturbance. The mammalian species known to be, or potentially, present in the permit area have shown an ability to adapt to human disturbance in varying degrees, as evidenced by their continued presence in other mining and residential areas of similar, or greater, disturbance levels elsewhere in the region. Additionally, small mammal species in the area have a high reproductive potential and tend to re-occupy and adapt to altered and/or reclaimed areas quickly.

5.6.11.1.5 Raptors

ISR activities in the permit area would not impact regional raptor populations, though individual birds or pairs may be affected. ISR activity could cause raptors to abandon nest sites proximate to disturbance, particularly if activities encroach on active nests during a given breeding season. Powertech (USA) will develop a bald eagle mitigation plan for review and verification by SDGF&P. A copy of the plan will be provided to DENR. Other potential direct impacts would be injury or mortality due to collisions with project-related vehicular traffic. Construction activities that occur within or near active raptor territories could also cause indirect impacts such as reduction or avoidance of foraging habitats for nesting birds. However, surface disturbance will only occur in a small percentage of the overall permit area, and the low density of nesting raptors relative to the apparent availability of suitable habitat suggests that alternate nesting habitat is available for all known nesting raptor species in the permit area.

Eight intact raptor nests were documented within the project survey area (permit area and 1-mile perimeter) during 2008. Six of the eight nest sites are within the permit area, with the remaining two located in the 1-mile perimeter. USFWS guidelines recommend avoiding construction activities within 660 feet if the activity will be visible from a nest (USFWS, 2007). Construction activities in relation to bald eagles and other raptors will be addressed in the bald eagle mitigation plan previously described.

Except for the bald eagle, the same species that nest in the permit area are known to regularly nest and fledge young at or near surface mines and ISR facilities throughout the region. Those efforts have succeeded due to a combination of raptors becoming acclimated to the relatively consistent levels of disturbance and gradual encroachment of production operations, and successfully executed state-of-the-art mitigation techniques to maintain viable raptor territories and protect nest productivity. Some individuals nest on active production facilities themselves, including both great horned owls and red-tailed hawks. The lack of bald eagle examples is more likely related to the general absence of nesting bald eagles in the vicinity, rather than an increased sensitivity to production activities. Bald eagles are discussed further in Section 5.6.11.1.11. Due to the paucity of river cliffs in the permit area, falcons and other raptors known to nest in that habitat are not as abundant as those that nest in trees or even on the ground.

Based on the location of known nest sites relative to future construction sites, no raptor nests will be disturbed physically by the project during either construction or operations. Additionally, Powertech (USA) has incorporated the baseline wildlife information into the planning process and sited all plant facilities (areas of greatest sustained future disturbance) outside the recommended buffer zone for all raptor nests in the permit area, including the bald eagle nest site. Some new infrastructure will be located within the suggested buffer areas. However, pipelines will be buried, and new overhead power lines will be constructed using designs and specifications to reduce injuries and mortalities on overhead power lines. Land application center pivots, if used, can be put into place prior to the nesting season, and run automatically with little human contact once they are turned on. Additionally, new roads, power lines, and pipelines will be constructed in the same corridors to the extent possible to reduce overall disturbance, and along existing access roads when available to minimize new surface disturbance.

5.6.11.1.6 Upland Game Birds

ISR activities in the permit area would potentially impact the foraging and nesting habitat of mourning doves, though such disturbance is not expected to have any marked impacts on this species. No woody corridors will be disturbed by the proposed activities, and additional trees are present in the cottonwood gallery along the Cheyenne River, located approximately 2 miles south of the permit area. Additionally, doves are not restricted to treed habitats, nor are they subject to any special mitigation measures for habitat loss.

Annual monitoring surveys conducted by SDGF&P biologists and a year-round baseline study for the project have demonstrated that sage-grouse do not currently inhabit that area, and have not for many years. As described previously, those surveys encompassed the entire permit area and the vast majority of its 2.0-km (1.2-mi) perimeter, particularly as part of baseline monitoring. The nearest known sage-grouse lek is approximately 6 miles north of the permit area (SDGF&P records). Given the lack of sage-grouse observations in the area and the scattered stands of marginal quality sage-grouse habitat, the project will not result in negative impacts to existing or potential sage-grouse leks, or important sagebrush habitats.

5.6.11.1.7 Other Birds

The project could potentially impact nine avian species tracked by SDNHP that are known to occur or could potentially occur as seasonal or year-round residents. Direct impacts could include injury or mortality due to encounters with vehicles or heavy equipment during construction or maintenance operations. Indirect impacts could include habitat loss or fragmentation and increased noise and activity that may temporarily deter use of the area by some species. Surface disturbance would be relatively minimal and would be greatest during construction. Enforced speed limits and use of common right-of-way corridors will reduce impacts to wildlife throughout the year, particularly during the breeding season.

5.6.11.1.8 Waterfowl and Shorebirds

Construction and operation of the ISR project would have a negligible effect on migrating and breeding waterfowl and shorebirds. Existing habitat is limited and seasonally available in the permit area, so it does not currently support large groups or populations of these species. Multiple approaches are being considered to minimize impacts to wildlife that may be associated with the operation of the ponds. Any new treated water sources could enhance current habitat conditions for these species, though such effects would be temporary in nature.

5.6.11.1.9 Reptiles and Amphibians

As with waterfowl, potential habitat for aquatic and semi-aquatic amphibians and reptiles is limited within the permit area and occurs primarily along Beaver Creek in the western portion of the area. Other water bodies are ephemeral, and thus offer only short-term habitat. Activities associated with the project are not expected to disturb existing surface water or alter the topography in the area. Those species residing in rocky outcrops located in potential disturbance areas could be impacted by construction and maintenance operations. However, few non-aquatic herptile species were observed in the permit area and surrounding perimeter. Any impacts that would occur would affect individuals, but would not likely impact the population as a whole.

5.6.11.1.10 Fish and Macro-Invertebrates

The planned locations for new facilities and infrastructure do not overlap any perennial aquatic features; therefore, no loss of aquatic habitat would occur as the result of their construction. The risk of impaired water quality will be reduced or avoided through project siting, and implementation of standard construction erosion and sediment control measures. The location of project facilities (CPP, Satellite Facility, pipelines, well fields, access roads and power lines), as well as the proposed land application sites (center pivot irrigation sites), will avoid direct impacts to perennial streams.

Due to the arid climate and proposed location of new project facilities, operation of the well fields is not expected to alter aquatic habitat or water quality in perennial streams. No surface water will be diverted for use in the operation, and no process water will be discharged into aquatic habitat.

Pass Creek provides only seasonal drainage and does not support fish or significant amphibian habitat. Some of the proposed land application sites west of the Satellite Facility would be located in general proximity to Beaver Creek, the primary aquatic habitat in the project vicinity. All land application areas will be surrounded by catchment areas that will prevent runoff. Beaver Creek will not be directly affected by the well field operations or land application sites. Section 3.5.4.1.1 describes how Beaver Creek and the Cheyenne River near the permit area are classified as warmwater, semipermanent fisheries. No coldwater fisheries are present in the permit area, and no impacts to coldwater fisheries will occur as a result of the Dewey-Burdock Project.

5.6.11.1.11 Threatened, Endangered, or Candidate Species and Species Tracked by SDNHP

Federally Listed Species

As described in the preceding sections of this document, no federally listed vertebrate species were documented in the project survey area (permit area and 1-mile perimeter) during the year-long survey period, or during previous targeted surveys conducted for the original claims (TVA, 1979). Additionally, the USFWS has issued a block clearance for black-footed ferrets in all black-tailed prairie dog colonies in South Dakota except northern Custer County, and in the entire neighboring state of Wyoming. That clearance indicates that ferrets do not currently, and are not expected to, occupy the permit area. Only one small black-tailed prairie dog colony was present in the permit area itself during the 2007-2008 baseline surveys, and local landowners are actively working to remove the animals from their lands. Consequently, the proposed project will have no direct, indirect, or cumulative effects on black-footed ferrets.

State-Listed Species

ISR activities within the permit area are not likely to adversely affect bald eagles, the only state-listed species known to inhabit the permit area. Bald eagles were documented at winter roosts and an active nest within the permit area. However, most roost sites and the lone nest site are at least 1.0 mile from the nearest planned facility. Additionally, no more than two or three bald eagles were observed during any given winter survey despite the numerous available (and unoccupied) mature trees along Beaver Creek, Pass Creek, and the pine breaks located in and near the permit area. Three proposed land application sites (center pivot irrigation systems) would fall within the one-mile buffer of the bald eagle nest. However, those systems are typically automated, and the minimal disturbance associated with potential maintenance of those systems should not be significant enough to impact nesting or roosting bald eagles along Beaver Creek.

Potential direct impacts to bald eagles include the potential for injury or mortality to individual birds foraging in the permit area due to electrocutions on new overhead power lines. Although not expected, disturbance activities near an active nest could result in abandonment and, thus, the loss of eggs or young. The increased human presence and noise associated with construction activities, if conducted while eagles are wintering within the area, could displace individual eagles from using the area during that period.

Given the low number of wintering and nesting bald eagles in the permit area, potential impacts would be limited to individuals rather than a large segment of the population. The use of existing or overlapping right-of-way corridors along with best management practices will minimize potential direct impacts associated with overhead power lines. If necessary, the majority of other potential impacts could be mitigated if construction activities were conducted outside the breeding season and/or winter roosting months, or outside the daily roosting period, should eagles be present within 1 mile of construction. Any bald eagles that might roost or nest in the area once the project is operational would be doing so in spite of continuous and ongoing human disturbance, indicating a tolerance for such activities.

Indirect impacts as a result of noise and human presence associated from project-related operations could include area avoidance by avian species. Potential winter foraging habitat could be further fragmented by linear disturbances such as overhead power lines and new roads associated with the project. Given the size of the project, those disturbances would occur within narrow corridors over relatively short distances. Nevertheless, the use of common right-of-way corridors to consolidate new infrastructure will reduce these potential indirect impacts.

The only other state-listed species recorded in the general area was the river otter. An otter carcass was discovered lodged in debris in the stream channel at fisheries sampling station BVC04 in mid-April 2008. That site is approximately 12 river miles upstream from the permit area boundary in eastern Wyoming. The carcass had washed away by the July 2008 fisheries sampling session. The monthly sampling at BVC04 during the monitoring period confirmed no additional observations of otters. Likewise, no evidence of otters was report by biologists along any drainage elsewhere in the survey area during the year-long baseline survey period. Given the fact that no stream channels will be physically impacted in the permit area, the lack of otter sightings or sign in the permit area itself, and the stringent water processing and water quality monitoring that will occur, this project is not likely to directly or indirectly impact river otters.

Species Tracked by SDNHP

Ten terrestrial species tracked by the SDNHP were recorded during baseline surveys, including the bald eagle. Seven of the ten were observed within the permit area, and three were seen in the 2-km perimeter. One additional species, the plains topminnow, was observed in Beaver Creek and the Cheyenne River, at least 1 mile outside the permit area. Three SDNHP species are known or suspected to have nested in the permit area in 2008. However, two of the three nest sites are at least 1 mile from the nearest planned new facility, and all three were closer to existing disturbances in 2008 than they would be to new activities outside those existing areas.

The seven SDNHP species recorded in or flying over the permit area could potentially experience the same type of direct and/or indirect impacts from construction and operation of the proposed operation as those described previously for other species: e.g., injury, mortality, avoidance, displacement and increased competition for resources. Those potential impacts will be minimized by the timing, extent, and duration of the proposed activities. Enforced speed limits during all phases of the project will further reduce potential impacts to wildlife throughout the year, particularly during the breeding season. Once facilities and infrastructure are in place, animals remaining in the permit area would demonstrate an acclimation to those disturbances.

5.6.11.2 Mitigation of Potential Ecological Resources Impacts

The following is a list of proposed mitigation measures for such potential impacts:

• Design fencing to permit big game passage to the extent practicable.

• Use existing roads when possible and limit construction of new access roads to provide for access to more than one well site or well field, if possible.

• Enforce speed limits to minimize collisions with wildlife, especially during the breeding season.

• Adhere to timing and spatial restrictions within specified distances of active raptor nests during the breeding season as determined by appropriate regulatory agencies.

• Develop a bald eagle mitigation/management plan for review and approval by the USFWS. The plan also will be provided to the SDGF&P for review and input, although the USFWS will have the final approval authority. The approved plan and any associated permits will be incorporated into the LSM permit. The bald eagle mitigation/management plan is anticipated to address the following:

o Ensure that annual bald eagle monitoring and survey data for nest and winter roost sites are available within the permit area and buffer area for the life of mine to:

 determine normal habitat use and movements,

 determine the location and status of nests and winter roost sites, and

 document the occurrence and outcome of nesting bald eagle pair(s).

o Establish buffer zones protecting important bald eagle habitat where necessary and stipulating seasonal restrictions on ISR-related disturbances within buffer areas in order to avoid jeopardizing bald eagles during any project phase. Such buffer zones and their associated seasonal restrictions would be established:

 in keeping with current USFWS recommendations,

 around nest sites, and

 around documented winter roost sites).

o If necessary, obtain a USFWS-issued permit and any necessary State permits for eagle take and/or nest relocation or removal, the application for which would address the following:

 demonstration that the proposed activity meets the requirements of 50 CFR § 22.26 or § 22.27, which contain the federal requirements for take and removal/relocation of eagle nests, respectively;

 methods to relocate the nest(s) or construct an alternate nest and/or improve conditions at alternate nest sites, if mitigation measures are required around documented winter roost sites);

a demonstration that suitable nesting and foraging (including winter) habitat is available to the area nesting population of bald eagles that could accommodate any bald eagles displaced by the take or nest removal/relocation; and

implementation of monitoring and reporting procedures to determine the response of bald eagles to the take or nest relocation(s).

- If direct impacts to raptors or other migratory bird species of concern occur, a Monitoring and Mitigation Plan for those species will be prepared and approved by the USFWS, including one or more of the following provisions:

o Relocation of active and inactive raptor nests that could be impacted by construction or operation activities in accordance with the approved raptor monitoring and mitigation plan.

o Creation of raptor nests and nesting habitat through enhancement efforts such as nest platforms to mitigate other nest sites impacted by ISR operations.

o Obtaining appropriate permits for all removal and mitigation activities.

o Establishing buffer zones protecting raptor nests where necessary and restricting ISR-related disturbances from encroaching within buffers around active raptor nests from egg-laying until fledging to prevent nest abandonment, or injury to eggs or young.

o Reestablishing the ground cover necessary to attract and sustain a suitable raptor prey base after drilling, construction, and future ISR operations and site reclamation/decommissioning

o Required use of raptor-safe construction for overhead power lines according to current guidelines and recommendations by the USFWS

- Restore pre-mining native habitats for species that nest and forage in those vegetative communities.

- Restore diverse landforms, replace topsoil, and construct brush piles, snags, and/or rock piles to enhance habitat for wildlife.

- Conduct weed control as needed to limit the spread of undesirable and invasive, non-native species on disturbed areas.

Adjusting the timing of various construction, operational, and reclamation activities to avoid the breeding season can also be an effective way to minimize impacts related to such activities in the permit area. As a practical matter, worker crews conducting construction or reclamation activities typically work during daylight hours, so potential impacts to year-round residents, particularly more nocturnal species such as bats, rodents and others, should not be increased significantly. Following completion of construction in a given area, access roads would be blocked with berms or fencing to prevent use by casual traffic. Site reclamation/ decommissioning, including surface reclamation, will be completed in the same manner, with activities timed to minimize disturbance to nesting or migrating species.

Relevant agency standards for reclamation will be followed and this phased, systematic approach will allow more mobile wildlife species to relocate into adjoining, undisturbed habitat and then return following completion of construction or reclamation in a particular area. Thus, the sequential, phased nature of this approach will decrease potential direct and indirect impacts on all wildlife species and their habitat.

4.6 Ecological Resources Impacts

As discussed in GEIS Section 4.4.5, potential environmental impacts to ecological resources, including both flora and fauna, could occur during all phases of the ISR facility lifecycle (NRC, 2009a). Impacts could include removal of vegetation from the site (with the associated reduction in wildlife habitat and forage productivity and an increased risk of soil erosion and weed invasion); modification of existing vegetative communities as a result of site activities; loss of sensitive plants and habitats; and the potential spread of invasive species and noxious weed populations. Impacts to wildlife could include loss, alteration, and/or incremental fragmentation of habitat; displacement of and stresses on wildlife; and direct and/or indirect mortalities. Aquatic species could be affected by disturbance of stream channels, increases in suspended sediments, fuel spills, and habitat reduction.

GEIS Construction Phase Summary

As discussed in GEIS Section 4.4.5.1, during construction, terrestrial vegetation may be affected through (i) the removal of vegetation from the milling site (and associated reduction in wildlife habitat and forage productivity and an increased risk of soil erosion and weed invasion); (ii) the modification of existing vegetative communities; (iii) the loss of sensitive plants and habitats as a result of clearing and grading; and (iv) the potential spread of invasive species and noxious weed populations. (NRC, 2009a)

The percentage of vegetation removed and land disturbed by construction activities evaluated in the GEIS (from less than 1 percent up to 20 percent) will cause a SMALL impact compared to the total permit area and surrounding plant communities. The GEIS evaluated ISR facilities that ranged in facility size from 1,000 to 7,000 ha [2,471 to 17,297 ac] with disturbed area estimates of 49 to 753 ha [120 to 1,860 ac]. Additionally, NRC staff concluded in the GEIS that clearing of herbaceous vegetation in an open grassland or shrub steppe community was expected to have a short-term SMALL impact, given the rapid colonization of annual and perennial species in the disturbed areas. The clearing of wooded areas could have a long-term impact given the pace of natural succession, and such impacts could range from SMALL to MODERATE, depending on the amount of surrounding woody areas. Noxious weeds will be expected to be controlled with appropriate spraying techniques, and therefore impacts will be SMALL. (NRC, 2009a)

GEIS evaluation of impacts during construction included terrestrial wildlife that may be affected through (i) habitat loss or alteration and incremental habitat fragmentation, (ii) displacement of wildlife from project construction, and (iii) direct and/or indirect mortalities from project construction. NRC staff noted in the GEIS that construction impacts to wildlife habitat will be minimized with the timely reseeding of disturbed areas following construction. In general, wildlife species will be expected to disperse from the proposed license area as construction activities approached, although smaller, less mobile species could perish during clearing and grading. Habitat fragmentation, temporary displacement, and direct or indirect mortalities will be possible; thus, the potential impact on terrestrial wildlife from construction could range from SMALL to MODERATE. (NRC, 2009a)

GEIS Operations Phase Summary

As discussed in GEIS Section 4.4.5.2, wildlife habitats could be altered by operations (fencing, traffic, and noise), and limited wildlife mortalities could occur due to conflicts between species habitat and operations. Fencing could limit access to crucial wintering habitat and water. South Dakota does not specify fencing construction. However, SDGFP field and regional personnel evaluate fencing construction design on a case-by-case basis, which may minimize impediments to big game movement (SDGFP, 2008). NRC staff noted in the GEIS that potential impacts to vegetation may occur as a result of land application of wastewater, increasing vegetation growth and/or negatively affecting vegetation from the build-up of salts in the soils. Licensee requirements to monitor and control irrigated areas will limit impacts to ensure release limits are met (NRC, 2009a).

As further indicated in GEIS Section 4.4.5.2, temporary contamination or alteration of soils could occur from operational leaks and spills and possibly from transportation or land application of treated wastewater. However, detection and response to leaks and spills (e.g., soil cleanup) and eventual survey and decommissioning of all potentially impacted soil will limit the magnitude of impacts to terrestrial ecology. The implementation of spill detection and response plans will mitigate impacts to aquatic species from spills around well heads and from pipeline leaks. Mitigation measures, such as SDGFP-recommended fencing and netting for ponds (SEIS Section 1.7.3.7), leak detection and spill response plans, and periodic wildlife surveys, will also limit the potential impact, and the NRC staff concluded in the GEIS that the impact to wildlife and vegetation will be SMALL. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

GEIS Section 4.4.5.3 describes potential impacts to ecological resources during the aquifer restoration phase that are similar to operations. These impacts could include habitat disruption, spills and leaks, and animal mortalities. Because existing (in-place) infrastructure will be used during aquifer restoration, little additional ground disturbance will occur, and therefore potential impacts will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

NRC staff concluded in the GEIS that land use impacts from decommissioning an ISR facility will be comparable to, but overall less than, those described for construction and will further decrease as decommissioning and reclamation proceed. As described in GEIS Section 4.4.5.4, during decommissioning and reclamation, there will be temporary land disturbance from soil excavation, recovery and removal of buried piping, and demolition and removal of structures. Wildlife will be temporarily displaced, but will be expected to return after decommissioning and reclamation are complete and vegetation and habitat are reestablished. Wildlife could come in conflict with heavy equipment or vehicles. Decommissioning and reclamation activities could also result in temporary increases in sediment load in local streams, but aquatic species will recover quickly as sediment load decreases. However, revegetation and recontouring will restore habitat previously altered during construction and operations. Land that is used for irrigation will be included in decommissioning surveys to ensure potentially impacted (contaminated) areas will be appropriately characterized and remediated, as necessary, in accordance with NRC regulations. As a result, the potential impacts to ecological resources during decommissioning are expected to be SMALL. (NRC, 2009a)

Potential environmental impacts to ecological resources from construction, operations, aquifer restoration, and decommissioning for the proposed Dewey-Burdock ISR Project are provided in the following sections.

4.6.1 Proposed Action (Alternative 1)

The staff's ecological impact analysis for the proposed Dewey-Burdock ISR Project site involves evaluating interactions between the proposed project activities and the local animals and habitat that could be affected by the project. If an applicant or licensee adhered to recommended applicant plans to initiate construction activities outside the recommended time restriction periods (Powertech, 2009a); however, activities will continue year round within the area of approved disturbance (e.g., wellfield patterns, roads, plant areas). BLM South Dakota wildlife timing restrictions are included in the table in the Raptors section.

4.6.1.1.1.1 Construction Impacts on Terrestrial Ecology

The terrestrial ecology of the proposed Dewey-Burdock ISR Project is discussed in the following sections. Potential impacts to vegetation and wildlife from construction for the deep Class V injection well disposal option are described in Sections 4.6.1.1.1.1.1 and 4.6.1.1.1.1.2, respectively.

4.6.1.1.1.1.1 Construction Impacts on Vegetation

For the deep Class V injection well disposal option, the applicant estimates that the land disturbed will be approximately 42 ha [103 ac] excluding wellfields (Powertech, 2010a). Potential wellfields will disturb an additional 57 ha [140 ac]. The wellfields, Burdock central plant, Dewey satellite plant, and deep Class V injection wells at the proposed project will be located primarily within the upland grassland and greasewood shrubland vegetation communities, and smaller disturbed areas within the big sagebrush shrubland, silver sagebrush shrubland, and ponderosa pine woodland communities. Table 4.6-1 provides the land disturbance by vegetation type for the Class V injection well disposal option. Figure 4.6-1 depicts the planned activities in relation to the vegetation communities.

Direct impacts from construction activities at the proposed project for the deep Class V injection well disposal option will include vegetation disturbance (modification of structure, species composition, and areal extent of cover types) of about 98 ha [243 ac]. Indirect impacts will include the short-term and long-term increased potential for noxious species [e.g., Canada thistle (*Cirsium arvense),* houndstongue *(Cynoglossum officinale)*, and field bindweed

(*Convolvulus arvensis)*] invasion, establishment, and expansion; potential soil erosion; shifts in species composition or changes in vegetative density; reduction of wildlife habitat; reduction in livestock forage; and changes in visual aesthetics.

As previously stated, the construction activities, increased soil disturbance, and increased traffic during construction for the Class V injection well disposal option could stimulate the introduction and spread of undesirable, invasive, nonnative species within the proposed license area. One state- and two county-listed noxious weeds, Canada thistle and field bindweed, respectively, were observed in the proposed project area during the applicant-conducted baseline surveys. These species are perennial and may quickly invade large areas depending on the season of the year. The applicant has proposed mitigation measures, which include conducting weed control as needed to limit the spread of noxious, invasive, and nonnative species on disturbed areas (Powertech, 2009a). If the applicant uses herbicides as a weed control method, the applicant should take precautions to minimize potential impact to the environment. Herbicides can drift to unintended areas due to wind and soil erosion, eliminate desired species from an area, and leave soil susceptible to erosion if not used and managed properly. For example, herbicides formulated with surfactant are toxic to fish and aquatic life and should not be used in or near water (Zollinger, 2012). Plant and wildlife species could be unintentionally impacted during normal application from indirect contact of herbicide residue and consumption of prey affected during application. South Dakota State University published a 2013 weed control guide (Moechnig, et al., 2012) for pastures and range land with recommended techniques, herbicides, and precautions to control regional noxious, invasive, and nonnative vegetative species that the applicant could employ. Applicant use of weed control techniques that incorporate South Dakota State University weed control guidance (Moechnig, et al., 2012) and BLM mitigation and reclamation guidelines (BLM, 2012a) will reduce potential impacts to wildlife and desirable vegetation from use of herbicides.

In areas where vegetation was removed, the applicant has committed to reestablish vegetation concurrently with construction activities according to NRC licensee requirements to conduct reclamation under an approved site reclamation plan (Powertech, 2009a). For the proposed

Dewey Conveyor project, BLM concluded that reestablished vegetation in this region often consists of annual forbs and native cool grasses with few shrubs for the first couple of years (BLM, 2009). Reestablishment of herbaceous plant cover can usually be completed within a few years, but reestablishment of shrubland communities may take much longer. SDDNER recommends that the large-scale mine permit include conditions requiring (i) concurrent and interim reclamation in all areas where mining or land disturbance is completed; (ii) that revegetation success be equivalent to vegetative cover in reference areas using SDDENR-approved statistical methods; and (iii) that a post closure bond be held for 30 years after the reclamation bond is released to help ensure revegetation success. However, final permit conditions may change based on the final determination by the hearing board.

If active revegetation measures are used with Natural Resource Conservation Service (NRCS)-, SDDENR-, and BLM-approved seed mixtures, rapid colonization by annual and perennial herbaceous species in the disturbed staging areas and rights-of-way will restore most vegetative cover within the first growing season (NRC, 2009a). On BLM land, BLM reclamation guidelines will be required to provide for stable soils and achieve vegetation cover; however, the exact species is not necessarily required, similar to the predisturbance cover (BLM, 2012a). BLM could require the applicant to reseed areas where initial seeding was not successful. Reclamation and reseeding, as soon as practicable following project completion, in accordance with a reclamation plan will ensure that vegetative communities are restored as

reestablishing, as soon as conditions allow, vegetation in disturbed areas with the BLM-, NRCS-, and SDDENR-approved native seed mixture and rate provided in Table 4.6-2 (Powertech, 2009a, 2012b).

Construction of wellfields will be phased and some vegetation will be affected, but impacts will not generally affect a sizeable segment of any species' population. In general, vegetation development in the region is expected to be sparse due to the limited amount of annual precipitation. To mitigate the potential impact to vegetation, disturbed areas will be both temporarily and permanently revegetated and tilled where soil has been compacted to promote vegetation growth in accordance with SDDENR regulations and the mine permit (Powertech, 2009a). Some encroachment from native populations and/or establishment of early successional species bordering disturbed areas will also be expected, which will facilitate the revegetation process. Additionally, the applicant will take mitigative measures to minimize the spread of noxious weeds (Powertech, 2009a).

No federally listed threatened or endangered plant species are known to occur within the proposed project area (FWS, 2010). Therefore, the NRC staff conclude the impact on federally listed plant species during the construction phase will be SMALL, based on the foregoing analysis that about 98 ha [243 ac] of vegetation will be disturbed primarily in the upland grassland and greasewood shrubland vegetation communities. The applicant commits to mitigation measures that will reduce the overall impacts, but vegetation could still experience long-term impacts especially within the sagebrush shrubland communities. The NRC staff conclude construction impacts on vegetation for the deep Class V injection well disposal option will be SMALL.

4.6.1.1.1.1.2 Construction Impacts on Wildlife

As described in SEIS Section 1.2, the total amount of BLM-managed land expected to be disturbed by the applicant over the life of the proposed project is 4.7 ha [11.63 ac]. The majority of the disturbed BLM land consists of the upland grassland vegetation community southwest of the central processing plant in the Burdock area. A proposed access road will border BLM land in

Table 4.6-1. Disturbed Land by Vegetation Type for Dewey-Burdock Deep Class V Injection Well Disposal Option

Activity	Vegetation Community (Hectares [acres])							Total Disturbed Area Hectares [acres]
	Big Sage-Brush Shrub-Land	Cotton-wood Gallery	Grease-wood Shrub-land	Mine Pit	Ponderosa Pine Wood-land	Silver Sage-Brush Shrub-land	Upland Grass-land	
Site Facilities	0.8 [2]	0	3.2 [8]	0	0.4 [1]	0	5.7 [14]	9.7 [24]
Trunklines	2.4 [6]	0	2.4 [6]	0	1.2 [3]	0.8 [2]	3.2 [8]	10.1 [25]
Access Roads	2.0 [5]	0	2.0 [5]	0.4 [1]	0.8 [2]	0.4 [1]	2.4 [6]	8.5 [21]
Well Fields	8.5 [21]	0	18.2 [45]	2.0 [5]	8.5 [21]	4.4 [11]	15.0 [37]	56.6 [140]
Impound-ments	0	0	4.1 [10]	0	0	0	9.3 [23]	13.3 [33]
Totals	13.8 [34]	0	29.9 [74]	2.0 [5]	10.9 [27]	5.7 [14]	36.0 [89]	98.3 [243]
Source: Powertech 2012a								

Figure 4.6-1. Map of Dewey-Burdock Planned Facilities and Vegetation Communities for the Deep Class V Injection Well Disposal Option
(Source: Powertech, 2012a)

the greasewood shrubland vegetation community. A proposed "restoration line" will traverse a corner of BLM land in the big sagebrush shrubland vegetation community outside of the ISR project boundary.

Planned land disturbance of about 98 ha [243 ac] during construction will be noncontiguous acres composed of the Burdock central plant, the Dewey satellite plant, and associated storage facilities; deep Class V disposal wells; wellfields and the associated infrastructure (e.g., pipelines and header houses); and new access roads. Most of the habitat disturbance will consist of scattered, confined drill sites for wells in the wellfields, which will not result in large expanses of habitat being dramatically transformed from their original character as in surface mining operations.

Indirect impacts could occur from displacement of wildlife from increased noise, traffic, or other disturbances associated with the development of the proposed project and from small reductions in existing or potential cover and forage due to habitat alteration, fragmentation, or loss. Indirect impacts typically persist longer than direct impacts. However, ISR uranium extraction does not generally involve large-scale habitat alteration.

Certain vegetative communities that exist in the proposed license area could be difficult to reestablish through artificial planting and natural seeding, and recovery could take many years. Consequently, wildlife species associated with specific habitats, such as blue grama (*Bouteloua gracilis)* grasslands and big sagebrush, could be reduced in number or replaced by generalist species with broader habitat requirements until natural reseeding of certain vegetation occurs or reclamation matures to its target mix. The proposed project area is dominated by big sagebrush shrubland followed by greasewood shrubland, ponderosa pine woodland, and upland grassland.

The latter three vegetative communities are almost equal in area. The wildlife species using these habitat types are limited in their occurrence in the proposed license area (see SEIS Section 3.6.1.2), and because the actual surface disturbance will be small and noncontiguous, negative impacts to these wildlife species will be SMALL. In addition, the NRC staff conclude that construction impacts resulting from habitat loss or alteration, displacement of wildlife, and mortality due to encounters with vehicles or heavy equipment at the proposed project will be SMALL. The applicant commits to impose and enforce speed limits during all ISR phases to reduce impacts to wildlife throughout the year and particularly during the breeding season (Powertech, 2009a, Section 5.5). To mitigate habitat disturbance, the applicant will use existing roads when possible and limit construction of new primary and secondary roads to provide access to more than one drill site (Powertech, 2009a). In addition, the applicant will restore areas where topsoil has been replaced and construct brush piles and rock piles to enhance wildlife habitat (Powertech, 2009a).

Big Game

Pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), white-tailed deer (*O. virginianus*), and elk (*Cervus elaphus*) are the four most common big game species that occur within the proposed project area, and bighorn sheep (*Ovis canadensis*) and mountain lions (*Felis concolor)* are predicted to be in the vicinity of the site. As described in Section 3.6.1.2.1, no crucial big game habitat or migration corridors occur on or within at least 1.6 km [1 mi] of the proposed Dewey-Burdock ISR Project (SDGFP, 2010a; BLM, 2011). Pronghorn antelope, mule deer, white-tailed deer, and elk in the project area could be directly affected by the disturbance of a portion of yearlong range, loss of forage, and vehicular collision [243 ac] will be incrementally disturbed during the life of the proposed project. Pronghorn antelope will be the most impacted big game species because they are the most common within the project area. Pronghorn antelope are sagebrush obligates occupying shrubland habitat year round and eating shrubs. Shrubland vegetation communities cover about 45 percent of the proposed project areas. Mule deer are also found in the project area all year and eat shrubs, but mule deer also enjoy grassland and riparian vegetation habitats and eating grasses and forbs. Elk compete seasonally with horses and cattle in the grassland vegetation community for their preferred food in spring and summer, and are found mostly in the ponderosa pine woodland habitat on the proposed site in fall and winter. Grassland and pine woodland habitats together comprise about 22 percent of the proposed project area. White-tailed deer, the least common big game species in the proposed project area, prefer the treed cottonwood gallery vegetation habitat, which comprises about 2 percent of the proposed project area. (Powertech, 2009a)

Because of these habitat disturbances, the yearlong range-carrying capacity for big game will be reduced over the life of the ISR facility. The SDDENR large scale mine permit will require that reclaimed rangeland is capable of withstanding proper (animal) stocking rates for two consecutive years after the life of the ISR facility prior to bond release. During the construction phase of the proposed project, the projected daily traffic on Dewey Road, the road nearest the proposed site, is estimated to increase by approximately 182 percent (see SEIS Sections 4.3.1.1). This increase in traffic will increase the potential for traffic collisions and wildlife or livestock kills. However, direct impacts to pronghorn antelope, mule deer, white-tailed deer, and elk will be SMALL because the continued existence of the species will not be threatened as a result of vehicle collisions.

Indirect impacts to pronghorn antelope, mule deer, white-tailed deer, and elk could include displacement into surrounding areas from increased human activity, noise, lighting, and the increased potential for poaching and/or harvest from improved access via new roads. Migration of these species toward the Black Hills may also increase predation from other animals. Mountain lions present in the Black Hills prey on white-tailed deer, mule deer, elk, bighorn sheep, and mountain goats (SDGFP, 2010b). The human presence during construction could affect big game use of adjacent areas. Some short-term disturbance (during the lifecycle of the ISR facility) of big game habitat could occur because of the proposed project construction. Adequate big game habitat exists in the surrounding area; these species could return to the areas affected by construction once these activities were completed. The proposed staged reclamation of disturbed areas will provide grass and forage within a few years of habitat disturbance. To the extent practicable, the applicant has proposed implementing speed limits within the proposed project area and fencing to permit big game passage as mitigative actions, and vegetative forage losses from construction will be mitigated by the applicant's plan for staged reclamation of disturbed areas to further reduce big game conflicts associated with the proposed construction activities (Powertech, 2009a). NRC staff conclude that because big game animals are highly mobile species and staff does not expect long-term effects on big game populations from the deep Class V injection well disposal option, the potential impacts to these species during the construction phase will be SMALL.

Upland Game Birds

The only upland game birds observed within the proposed Dewey-Burdock ISR Project area are the wild turkey (*Meleagris gallopavo*) and mourning dove (*Zenaida macroura*), which are can be found across fields to woodlands and residential areas. Doves are opportunists and eat the seeds of grasses, forbs, and crops as they ripen, changing their feeding habits as different foods become available (SDGFP, 2009a). Essentially all of South Dakota and Wyoming provides habitat that support mourning doves, including the area that surrounds the proposed license area; therefore, the proposed project will not threaten the continued existence of mourning doves.

Within the proposed project area, wild turkeys will most likely use the cottonwood gallery and ponderosa pine vegetative communities, woody draws, and riparian areas along Beaver Creek for roosting, feeding, nesting, and brood rearing (SDGFP, 2009b). Hens will also select the upland grassland community for nesting if tall grasses were present (SDGFP, 2009b). While woody corridors are not abundant in the proposed project area, they also are not unique in the surrounding area. Black Hills National Forest (BHNF) borders the proposed project area to the east and provides ample habitat that could support displaced turkeys during construction activities. Because turkeys wander great distances and require large areas of suitable habitat, NRC staff do not expect the proposed project construction will impact the general population of wild turkeys.

SEIS Section 3.6.1.2.2 explains that sharp-tailed grouse (*Tympanuchus phasianellus*), ruffed grouse (*Bonasa umbellus*), and Greater sage-grouse *(Centrocercus urophasianus)* could potentially occur in the proposed project area. Greater sage-grouse is the most likely grouse species to potentially be impacted by construction of the proposed Dewey Burdock ISR project because of the regional decline and segmentation of sagebrush habitat. As discussed in SEIS Section 3.6.3, Greater sage-grouse are not reported to occur within 6.4 km [4 mi] of the proposed project boundary. Because NRC staff expect that similar habitat is present in the proposed project area that U.S. Fish and Wildlife Service (FWS) evaluated for the nearby Buffalo Gap National Grassland (described in SEIS Section 3.6.3; Hodorff, 2005), it is unlikely that optimum canopy coverage of sagebrush habitat is present to support breeding and wintering populations within the proposed project area.

In recent years, BLM and state agencies in the region have developed strategies and management measures to preserve, conserve, and restore the sagebrush habitat to prevent further population decline and prevent the listing of the sage-grouse as threatened or endangered species under the Endangered Species Act (ESA). BLM is in the process of revising RPMs and has initiated scoping to prepare an EIS; this will require detailed studies on proposed and alternative policies, and analysis of how implementation of the policies may affect the environment (BLM, 2012d). The BLM Rocky Mountain Region expects several final EISs to be published in 2014, which may identify new issues and best management strategies for sage-grouse that may also benefit other upland game birds. FWS is required to make a decision in 2015 on whether to propose protecting the species under the ESA (FWS, 2012a). In August 2012, FWS issued a draft report to help achieve sage-grouse conservation objectives before the 2015 decision. Recommendations from these studies could be implemented at the proposed Dewey-Burdock ISR Project when they are finalized and become available.

Portions of the proposed Dewey-Burdock ISR Project site will be disturbed during construction activities; therefore, some birds will be displaced and some temporary habitat loss will occur. The applicant commits to (i) minimize disturbance of surface areas and vegetation, where possible; (ii) minimize construction of new access and secondary roads so more than one drill site can be accessed; and (iii) construct new roads, power lines, and pipelines in the same disturbance (Powertech, 2009a). All lands disturbed by project activities will be concurrently revegetated following approved reclamation practices (Powertech, 2009a), which will restore the habitat loss experienced from proposed construction activities. In addition, the applicant has committed in its application to adhere to regulatory timing and spatial restrictions (noise, vehicular traffic, and human proximity) as a mitigative measure that will decrease impacts during breeding season (Powertech, 2009a). Because the site does not support populations of upland game birds that depend on the site for continued existence and because mitigation measures are expected to limit potential impacts to upland game bids, NRC staff conclude potential impacts to upland game birds during the construction phase for the deep Class V injection well disposal option will be SMALL.

Raptors

Twelve species of raptors were recorded within the proposed license area during Powertech's wildlife survey: bald eagle (*Haliaeetus leucocephalus*) (nested), red-tailed hawk (*Buteo jamaicensis*) (nested), golden eagle (*Aquila chrysaetos*), ferruginous hawk (*Buteo regalis*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), turkey vulture (*Cathartes aura*), Cooper's hawk (*Accipiter cooperii*), rough-legged hawk (*Buteo lagopus*), merlin (*Falco columbarius*) (nested), great horned owl (*Bubo virginianus*) (nested), and long-eared owl (*Asio otus*) (nested) (Powertech, 2009a). As explained in SEIS Section 3.6.1.2.3, the burrowing owl (*Athene cunicularia*), northern saw-whet owl (*Aegolius acadicus*), and sharp-shinned hawk *(Accipiter striatus)* could be present in the vicinity of the proposed project area (Peterson, 1995). Although some of these raptors (bald eagle, burrowing owl, ferruginous hawk, and golden eagle) are considered BLM sensitive species, the populations of these species are not imperiled with the exception of the bald eagle, which is a state-threatened species (SDGFP, 2012a). The bald eagle, red-tailed hawk, American kestrel, and northern harrier were the most commonly seen raptor species in the proposed project area and will be the primary raptor species impacted by project activities. Raptors are particularly sensitive to noise and the presence of human activity, which will be heightened during the ISR construction phase. Five raptor nests (four active and one unknown) were recorded within the proposed project area during surveys conducted in 2007 and 2008, as summarized by species in SEIS Table 3.6-2 (Powertech, 2009a). Two other nest sites, one inactive and one defended but not confirmed active, occurred within 1.6 km [1 mi] of the proposed license area. As described in SEIS Section 3.6.1.2.2, one active bald eagle nest was reported in 2011 within the proposed project area along Beaver Creek, about 1.6 km [1 mi] west of the proposed Dewey satellite processing plant.

Direct impacts to raptor species for the deep Class V injection well disposal option include displacement, loss of forage habitat, increased potential for collisions with structures and vehicles, increased potential for nest abandonment and reproductive failure due to increased human disturbances, and potential reduction in prey populations within the project site. Avian collision and electrocution with overhead power lines could occur year round. The potential for eagle collisions with electric transmission lines is considered to be low because their foraging behavior is relatively slow compared to falcons and other raptors. Indirect impacts to raptors could include nesting disruption and displacement of prey species, which may reduce food availability within the area. Nesting success by resident raptors could be reduced from disturbances caused by the proposed ISR construction and associated traffic. Birds may continue to use nest sites as they acclimate to the proposed ISR construction activities and could return to inactive nests in the area. The applicant has committed to adhering to timing and distance restrictions determined by appropriate regulatory agencies to protect raptor nests during breeding season (Powertech, 2009a). In addition, the applicant has committed to mitigation measures to limit noise and vehicular traffic (Powertech, 2009a) during the construction phase of the proposed project, which will reduce overall impacts to raptors. If a disturbance occurs (called a "take") where birds protected under the conventions are pursued, hunted, shot, wounded, killed, trapped, captured or collected in violation of the Bald and Golden Eagle Protection Act (BGEPA) and/or Migratory Bird Treaty Act (MBTA), the applicant will be required to perform a consultation and mitigation of the take with FWS. The applicant has committed to follow an FWS-approved raptor monitoring and mitigation plan to minimize conflicts between active nest sites and project-related activities if direct impacts to raptors occur (Powertech, 2009a). However, NRC staff anticipate there will be fewer direct impacts to raptors compared to a higher potential for indirect impacts. Mitigation measures provided in SEIS Chapter 6 will support the continued nesting success of area raptors and minimize potential direct and indirect impacts.

The applicant could mitigate potential impacts to raptor species from power distribution lines by following the Avian Power Line Interaction Committee guidance to avoid activities near active nests, especially prior to the fledging of young (Avian Power Line Interaction Committee, 2006). In addition, the applicant could site all planned facilities outside of the BLM-recommended buffer zone for all raptor nests identified within the proposed project area and adhere to BLM-recommended timing restrictions presented in table located in Table 4.6-3. Figure 4.6-2 shows the 16-ha [40-ac] areas where raptor nests are located near the proposed project area. The potential wellfield areas in Figure 2.1-6 identify where potential drilling/disruptive activity could occur around each orebody, if a particular orebody were mined. Based on the applicant's intent to follow a raptor mitigation plan and implementation of the mitigative measures previously described, the potential impact to raptor species during the construction phase of the proposed Dewey-Burdock ISR Project for the deep Class V injection well disposal option will be SMALL.

Waterfowl and Shorebirds

Eight avian species associated specifically with water and/or wetlands were observed during baseline surveys conducted at the proposed project site: the American white pelican (*Pelecanus erythrorhynchos*), great blue heron (*Ardea herodias*), Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), American wigeon (*Anas americana*), killdeer (*Charadrius vociferus*), long-billed curlew (*Numenius americanus*), and upland sandpiper (*Bartramia longicauda*) (Powertech, 2009a). In western South Dakota, long-billed curlew and

Table 4.6-3. BLM Recommended Seasonal Wildlife Stipulations (Cont'd)

Affected Areas/Species	Activities and/or Timing Restriction	Restricted Area
	Siting structures that are more than 3 m [10 ft] tall or power lines	Within a 3.2-km [2-mi] radius of nesting areas
Peregrine falcon	Prohibit surface disturbance/occupancy or human activity year round	Within 1.6-km [1-mi] radius of a nest including nests recorded during the preceding 7 breeding seasons*
Bald eagle	Prohibit surface disturbance/occupancy or human activity year round	Within a 0.8-km [0.5-mi] radius of a nest including nests recorded during the preceding 5 breeding seasons*
Golden eagle, osprey, burrowing owl, ferruginous hawk, Swainson's hawk, prairie falcon, other raptors	Prohibit surface disturbance/occupancy or human activity year round	Within a 0.4-km [0.25-mi] radius of occupied nest*
Greater sage-grouse	December 1–March 31	Within crucial winter range for greater sage-grouse. Routine maintenance, production, and emergency response activities are allowed.*
	March 1–July 1	Within a 3.2-km [2-mi] radius of a lek in general habitat areas. Routine maintenance, production, and emergency response activities are allowed.*
	Prohibit surface disturbance/occupancy or human activity year round	Within a 0.4-km [0.25-mi] radius of an occupied lek*
Piping plover	Prohibit surface disturbance/occupancy or human activity year round	Within a 0.4-km [0.25-mi] radius of piping plover habitat*
Interior least tern	Prohibit surface disturbance/occupancy or human activity year round	Within a 0.4-km [0.25-mi] radius of wetlands identified as least tern habitat*
Big game winter ranges	December 1–March 31	Surface-disturbing and disruptive activities in winter ranges*

*The authorized officer may grant an exception, modification, or waiver to a stipulation based on certain criteria
Source: BLM, 2012b,c,d

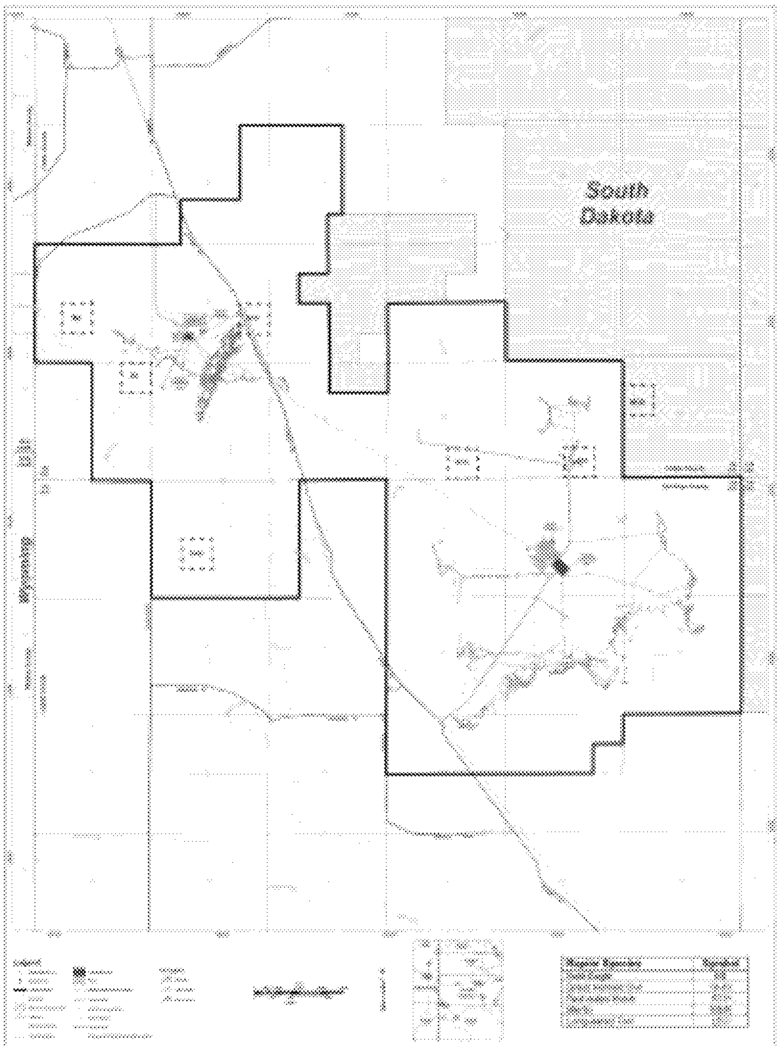

Figure 4.6-2. Map of Raptor Nest Locations in the Dewey-Burdock Project Area and Planned Facilities for the Deep Class V Injection Well Disposal Option
Sources: BLM, 2012c; SDGFP, 2012c; Powertech, 2012a

upland sandpiper are often found in grasslands, but habitat requirements in this environment are not well known (SDGFP, 2005a). As described in SEIS Section 3.6.1.2.2, the long-billed curlew is a rare species in South Dakota. A large portion of the curlew breeding range occurs in South Dakota, but does not include winter habitat (Fellows, 2009). The continued existence of the species is most threatened by fragmentation, vegetation conversion, and loss of breeding habitat consisting of open, mixed-grass prairie and grazed cattle pastures across its current breeding range (Fellows, 2009). Areas about 0.8 km^2 [0.5 mi^2] or larger of the upland grassland vegetative community {total 885.27 ha [2,187.56 ac]} are found in the Burdock area east of Pass Creek, which is more than in the Dewey area. Construction impacts will affect nesting and breeding curlew the most from early March to mid-July.

At the proposed Dewey-Burdock site, relatively little habitat exists to support large groups or populations of either waterfowl or shorebirds and no breeding waterfowl or shorebirds were observed during wildlife surveys; therefore, NRC does not expect that proposed construction activities for the deep Class V injection well disposal option will destabilize waterfowl or shorebird populations. The applicant has committed to use existing roads when possible and obtain USACE permits when appropriate before construction activities (SEIS Section 4.5.1.1.1.1.). These actions, in addition to reseeding and other mitigation measures explained in SEIS Section 4.6.1.1.1.1, will limit potential long-term impacts to waterfowl and shorebird habitat. Therefore, the potential impact to waterfowl and shorebirds during the construction phase for the deep Class V injection well disposal option will be SMALL.

Construction impacts to nongame and migratory birds for the Class V injection well disposal option are expected to be similar to those discussed for other birds previously described in this section associated with forested, grassland, and shrubland vegetative communities. Some long-term habitat loss {up to about 98 ha [243 ac]} and potential reduction in the carrying capacity for nongame/migratory birds within the proposed project area will occur; however, there is habitat available regionally for displaced animals. Direct impacts will include habitat loss and fragmentation, alteration of plant and animal communities, overhead electric line collisions and electrocution, and increased human activity or noise that could cause collision mortality or the birds to avoid a specific area or reduce breeding efficiency.

Nongame and Migratory Birds

Direct loss of ground nests, eggs, and birds from construction activities could occur; however, these impacts will affect only a few birds and are not expected to have any long-term impacts on the general population of the individual species. NRC expects the proposed project will not influence migratory movement patterns, because most bird species are able to fly over the area without restrictions. Nongame and migratory birds will benefit from mitigation measures described in Chapter 6 because these will limit noise, vehicular traffic, and other human disturbances near these areas. Therefore, the potential impact to nongame and migratory birds during the construction phase will be SMALL.

Other Mammals

A variety of small- and medium-sized mammal species occurs in all the vegetative communities present in the vicinity of the proposed license area, although not all have been observed on the proposed project area itself. These mammals include the coyote (*Canis latrans*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), bobcat (*Lynx rufus*), badger (*Taxidea taxus*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), skunk (*Mephitis mephitis)*, porcupine (*Erethizon dorsatum*), bats (*Myotis* spp.), and weasel (*Mustela* spp.) (Powertech, 2009a). Prey species including rodents (mice, rats, voles, shrews, pocket gophers, ground squirrels, squirrels, chipmunks, prairie dogs), jackrabbits (*Lepus* spp.), and cottontails (hares) (*Sylvilagus* spp.) could also inhabit the proposed project area.

Medium-sized mammals, such as rabbits, coyotes, and foxes, could experience some mortality or be temporarily displaced to other habitats during construction activities. Direct mortality or injury of some ground-dwelling small mammal species (e.g., voles, ground squirrels, mice) could be higher than for other wildlife because of their limited mobility and the likelihood they will retreat into burrows if disturbed. They could potentially be impacted by topsoil scraping or staging activities. However, given the limited, noncontiguous areas that will be affected by topsoil-disturbing construction activities (see Table 4.2-1), NRC expects no major changes or reductions in small- or medium-sized mammalian populations. Indirect impacts from accidental spills will be short term and localized to the impact area. The small- and medium-sized mammal species that occur in the proposed project area have a higher reproductive potential than do more vulnerable wildlife species that require large home ranges and occur in lower densities, such as large mammals (BLM, 2009). Construction disturbance associated with vehicles, equipment, noise, and dust will potentially cause wildlife species associated with all habitat types to avoid the area temporarily during construction activities; however, NRC staff expect that the area will not be uninhabitable after construction ends; therefore, the potential impact to other mammals from construction of the proposed Dewey-Burdock ISR Project will be SMALL. Potential construction impacts to black-tailed prairie dogs (*Cynomys ludovicianus*) and swift fox (*Vulpes velox)*, state endangered and state threatened species, respectively, are detailed in SEIS Section 4.6.1.1.1.1.4.

Reptiles and Amphibians

Three amphibian and one reptile species [boreal chorus frog (*Pseudacris triseriata*), Woodhouse's toad (*Bufo woodhousei*), great plains toad (*B. cognatus*), and western painted turtle (*Chrysemys picta*), respectively], which commonly occur in the region, were observed in the western portion of the project area along Beaver Creek where there are no currently planned activities associated with the proposed deep Class V injection well disposal option (Powertech, 2009a). Several other unidentified lizard species were observed during wildlife surveys conducted at the proposed site in 2007 and 2008 (Powertech, 2009a). The proposed project area provides limited habitat for amphibians and turtles due to the lack of aquatic habitat, which is concentrated along Beaver Creek and in old mine pits that make up about 10 ha [24 ac] of the total 14 ha [35 ac] of wetland habitat within the proposed project area. Within the proposed project area, Beaver Creek is a perennial stream and Pass Creek is an ephemeral stream that supports some intermittent habitat. All Beaver Creek and Pass Creek tributaries are ephemeral. During construction activities, reptile and amphibian species will experience impacts similar to those discussed for small- and medium-sized mammal species, which include loss or fragmentation of habitat, displacement, disturbance from noise and human proximity, and increased risk of vehicular collision.

Because the applicant does not plan to disturb water bodies and perennial streams within the proposed project area (Powertech, 2009a), staff expect that aquatic habitat will not be directly affected by the proposed project activities. In addition, SEIS Sections 4.5.1.1.1.1 and 4.5.1.1.1.2 describe mitigative measures in accordance with NPDES permit requirements; these measures will control the amount of pollutants entering surface water bodies, such as streams, wetlands, and lakes. For these reasons, NRC staff conclude potential impact to amphibian and reptiles, such as lizards and snakes that prefer grassland habitat, may be more susceptible to the potential human disturbances previously described. However, due to the small amount of habitat {about 98 ha [243 ac]} that will be disturbed at any given time during the deep Class V injection well disposal option and low likelihood for direct mortalities, staff do not expect construction impacts to measurably affect any reptile species population. Therefore, the potential impact to reptile species during the construction phase will also be SMALL.

4.6.1.1.1.3 Aquatic Ecology

GEIS Section 4.4.5.1 discussed impacts to aquatic species that could be temporarily disturbed by in-stream channel activities and concluded the potential impact will be SMALL. Sediment loads in streams are expected to taper off quickly both in time and distance, and long-term impacts will be SMALL. Additionally, SDDENR standard management practices will help to limit impacts to aquatic life. (NRC, 2009a)

Because of the limited and ephemeral nature of surface water at the proposed Dewey-Burdock ISR Project, the occurrence of aquatic species is also limited. Potential impacts to aquatic species at the proposed project site will occur primarily along Beaver Creek, Pass Creek, scattered stock ponds, and drainages. Beaver Creek is a perennial stream that experiences annual low flow conditions (see SEIS Section 3.6) and does not support sensitive species within the proposed project boundary. Further, EPA lists Beaver Creek as an impaired water body partially due to high dissolved and suspended solids (EPA, 2009). Pass Creek is an ephemeral stream that supports some intermittent habitat. However, Pass Creek does not provide a year-round source of surface water sufficient to maintain a population of aquatic species. The applicant's surface water management plan will limit the loss of aquatic habitat resulting from planned construction activities at the proposed project (Powertech, 2009a).

A baseline level of total uranium was detected in channel catfish during wildlife surveys (SEIS Section 3.6.2). SEIS Section 3.5.1 describes MCL exceedances in surface water samples collected onsite and offsite downstream for gross alpha, uranium, and Ra-226. EPA's national recommended water quality criteria for aquatic life and for human health consumption do not include gross alpha, uranium, or radium (EPA, 2012). No surface water will be diverted, no process water will be discharged into aquatic habitat, and stormwater runoff will be managed through the NPDES permit (as discussed in Section 4.5.1.1). SEIS Section 4.5.2 further describes that EPA requires a Class V UIC permit for deep Class V well injection. EPA will only allow Class V injection if the applicant can demonstrate that liquid waste could be safely isolated in a deep aquifer. In the permitted area, there is no evidence for any hydraulic connection between surface waters and proposed aquifers for the deep Class V injection well disposal option. NRC staff expect planned ISR construction activities, as described in SEIS Section 4.5.1.1, are unlikely to significantly affect surface water quality. Therefore, NRC staff conclude potential impacts to aquatic species and habitats from the construction phase for the deep Class V injection well disposal option will be SMALL.

4.6.1.1.1.1.4 Threatened and Endangered Species

As discussed in GEIS Section 4.4.5.1, if threatened or endangered species are identified on the proposed project site, the potential impact could range from SMALL to LARGE, depending on site conditions. Mitigation plans to avoid and reduce impacts to potentially affected species will be developed. (NRC, 2009a)

vegetative communities where the bald eagles are found will not be physically impacted by the proposed project construction or operations (Powertech, 2009a). Therefore, construction will not directly impact bald eagles. However, eagles nesting nearby or migrating through the area may use the proposed Dewey-Burdock site and surrounding lands for foraging during winter months and may not be able to use these lands during construction until the disturbed areas were reclaimed and prey species returned. The bald eagle is protected under the MBTA and the BGEPA, by which the applicant will have to abide. Although these statutes do not provide for habitat protection, disturbance of eagle habitat that directly takes or kills a bald eagle (such as cutting down a nest tree with chicks present) will constitute a violation of the MBTA, as well as the BGEPA.

Black-footed ferrets (*Mustela nigripes*) are not present in the site vicinity at this time (BLM, 2009a; FWS, 2010; SEIS Section 3.6.3). However, the presence of the black-tailed prairie dog (*Cynomys ludovicianus*) in the northwestern corner of the proposed project area provides potentially suitable habitat for the black-footed ferret. Two other prairie dog towns were observed 1.6 km [1 mi] southwest of the proposed project area. The black-tailed prairie dog is a state endangered and BLM sensitive species (see Tables 3.6-7 and 3.6-8). As discussed in SEIS Section 3.6.3, FWS relieved the requirement for black-footed ferret surveys to be conducted in black-tailed prairie dog habitat within the State of South Dakota for the purpose of identifying previously unknown ferret populations; therefore, Powertech did not conduct ferret surveys on the proposed Dewey-Burdock ISR Project site. FWS continues to direct federal agencies to assess whether a proposed action could have an adverse effect on the value of prairie dog habitat as a future reintroduction site for the black-footed ferret. Proposed construction activities may directly impact prairie dogs and habitat for the prairie dog and black-footed ferret within the proposed project boundary that could support populations of these species. Because there have been no occurrences of black-footed ferrets within the proposed project area and the prairie dog colony on the site is likely too small to support and sustain a breeding population of black-footed ferrets (as described in SEIS Section 3.6.3), NRC staff conclude that the proposed project construction will not result in a direct effect on current or future ferret populations.

Potential impacts to sage-grouse, a federal candidate species and BLM sensitive species, were discussed in SEIS Section 4.6.1.1.1.1.2 under Upland Game Birds. Listed threatened or endangered species or candidate animals will not be directly affected by construction activities for the deep Class V injection well option, nor will the habitats of these species' be noticeably altered. Therefore, the NRC staff conclude potential impacts from construction activities on federally listed threatened or endangered species, and candidate or delisted species, will be SMALL.

State and BLM Species of Concern

In addition to the BLM sensitive species listed in Table 3.6-7 that could occur within the proposed project area, the following South Dakota-designated rare animals were observed within the proposed project area during wildlife surveys: long-billed curlew, great blue heron, golden eagle, Cooper's hawk, American white pelican, long-eared owl, merlin, Clark's nutcracker (*Nucifraga Columbiana*), ferruginous hawk, and plains topminnow (*Fundulus sciadicus*) (Powertech, 2009a). State rare and BLM sensitive species are discussed in the following paragraphs. but were not observed, during surveys at the proposed site [marbled godwit (*Limosa fedoa*),

trumpeter swan (*Plegadis chihi*), willet (*Cataptrophorus semipalmatus*), and Wilson's phalarope (*Phalaropus tricolorl*)] and South Dakota rare animals observed during Dewey-Burdock wildlife surveys (long-billed curlew, great blue heron, and American white pelican in Table 3.6-8) are unlikely to be affected by construction activities because fairly limited suitable habitat exists year round to support large groups or populations of either waterfowl or shorebirds. None of the waterfowl or shorebirds observed during wildlife surveys were breeding; therefore, NRC staff do not expect that proposed construction activities will destabilize sensitive waterfowl or shorebird populations.

Raptors listed as BLM sensitive species that could occur at the proposed site are bald eagle, burrowing owl, ferruginous hawk, golden eagle, peregrine falcon *(Falco peregrines*), and Swainson's hawk (*Buteo swainsoni).* Each of these BLM sensitive species is protected under the MBTA, and the bald and golden eagles are also protected under the BGEPA. Similar to the bald eagle, the peregrine falcon is designated as threatened in South Dakota, but the peregrine falcon was not observed in the proposed project area. The peregrine falcon was once a federally listed species, but it was delisted in 1999. The falcon was presumed to be extirpated from the state by 1980 (USGS, 2006) and is not likely to occur within the proposed project area, although there are recent urban reintroduction efforts to restore the bird to the state (SDGFP, 2012b). Burrowing owls are dependent on large prairie dog towns for food and nesting in western South Dakota (SDGFP, 2005a,b). Several predatory raptor species, such as the ferruginous hawk, feed on prairie dogs and other small vertebrates or burrowing animals found in prairie dog towns. Some raptors, such as the Swainson's hawk, feed primarily on insects. During breeding season, the Swainson's hawk may consume small vertebrates.

State rare raptor species observed in the project area were Cooper's hawk, long-eared owl, and merlin. Each species is also protected under the MBTA. All raptors that occur at the proposed project site will experience potential impacts similar to those described for raptors in SEIS

Section 4.6.1.1.1.1.2. Raptors are particularly sensitive to noise and the presence of human activity, which will be heightened during the construction period. As described in SEIS Section 4.6.1.1.1.1.2, injury and mortality from encounters with power lines will be minimized by the applicant's proposed use of raptor deterrent products and following regulatory timing and spatial restrictions with respect to construction activities near raptor nests. The applicant has also committed to follow an FWS-approved raptor monitoring and mitigation plan to minimize conflicts between active nest sites and project-related activities if direct impacts to raptors occur (Powertech, 2009a). Nest abandonment and loss of eggs or fledglings could occur in raptor nests proximate to construction activities, especially during the early nesting period. Because of the presence of raptors within the proposed project area, sensitive and rare raptor species could be disturbed. However, the NRC staff conclude direct impact to raptors is unlikely and the continued existence of the species in the proposed project area will not be threatened due to proposed mitigation measures; these are further detailed in Chapter 6 and include best management practices for monitoring species. The NRC staff conclude the estimated impact on sensitive raptor species during the construction phase for the deep Class V injection well disposal option will be SMALL.

Nongame and migratory birds, such as the Chestnut-collared longspur (*Calcarius ornatus),* dickcissel (*Spiza americana),* and long-billed curlew, may occur within the proposed project area, most likely in the upland grassland vegetative community. The loggerhead shrike (*Lanius ludovicianus)* and blue-grey gnatcatcher (*Polioptila caerulea)* may also occur within the sensitive species and protected by the MBTA. The gnatcatcher and curlew are also rare state species. Potential impacts from construction on the long-billed curlew and nongame and migratory birds are discussed in SEIS Section 4.6.1.1.1.1.2. NRC staff expect that similar potential impacts described in SEIS Section 4.6.1.1.1.1.2, including injury or mortality from vehicles and electrical lines, fragmentation, vegetation conversion, and loss of breeding habitat, for nongame and migratory birds will also potentially impact chestnut-collared longspur, dickcissel, loggerhead shrike, and blue-grey gnatcatcher. For the proposed Dewey Conveyor Project, which is less than 1.6 km [1 mi] from the proposed Dewey-Burdock ISR Project, BLM staff concluded that while some species reliant on grassland habitat could be displaced, the area contains high density, undisturbed grassland and disturbed grassland species will use similar adjacent habitat (BLM, 2009). The staff also conclude that the grassland habitat in the vicinity of the proposed Dewey Burdock project area will temporarily support grassland species of concern that may be disturbed during construction. Further, NRC staff expect applicant mitigation measures, like those described in SEIS Section 4.6.1.1.1.1.2 and Chapter 6, will prevent destabilization of habitat or populations for these species. Therefore, the NRC staff conclude that potential impacts from construction on chestnut-collared longspur, dickcissel, loggerhead shrike, and blue-grey gnatcatcher will be SMALL.

Clark's nutcracker (*Nucifraga columbiana*), a BLM sensitive species and state rare species, is a nongame bird that was observed flying over the proposed project site during wildlife surveys. Nutcrackers prefer conifer forests (South Dakota Birds and Birding, 2012) and will most likely occur in the ponderosa pine woodland vegetative community in the proposed project site. Black-backed woodpecker (*Picoides arcticus),* veery (*Catharus fuscescens)*, and three-toed woodpecker (*Picoides tridactylus)* are all BLM sensitive species that inhabit forested areas such as the ponderosa pine woodland and cottonwood gallery vegetative communities. The red-headed woodpecker (*Melanerpes erythrocephalus),* a BLM sensitive species and state rare species, inhabits the edge of forested areas near open clearings. All of these birds are protected by the MBTA. NRC staff expect that potential impacts to these nongame and migratory birds associated with forest habitats will be less than those potential impacts described for nongame and migratory birds associated with grassland and shrubland habitats because (i) NRC expects that little to no treed areas will be directly disturbed during construction compared to other habitat types that will experience long-term or permanent impacts; (ii) the applicant has stated that no woody corridors will be disturbed by the proposed activities (Powertech, 2009a); and (iii) potential forest habitat is located in the adjacent BHNF dominated by ponderosa pine and other deciduous trees (Chapman, 2004) that could support displaced birds that depend on forest habitats. Therefore, the staff conclude the potential impact on Clark's nutcracker, black-backed woodpecker, veery, three-toed woodpecker, and red-headed woodpecker during the construction phase will be SMALL.

Two mammals, the black-tailed prairie dog (*Cynomys ludovicianus*), a state endangered species and BLM sensitive species, and the swift fox (*Vulpes velox)*, a state threatened species and BLM sensitive species, could potentially occur within the project area. As described earlier in this section and in SEIS Section 3.6.3, a black-tailed prairie dog colony is located proximate to potential wellfields D-WF3 and D-WF4 in the Dewey area and proposed standby land application sites; therefore potential direct impacts could affect prairie dogs if the wellfields and land application sites are used. A 2008 survey reported that the prairie dog populations more than doubled in Custer and Fall River Counties between 2003 and 2008, and that state prairie dog 2008 conservation population goals were met (Kempema, et al., 2009). Because of management programs to protect the species, prairie dog populations in South Dakota are stable where the species occurs in most of the western two-thirds of the state (SDGFP, 2012d). According to SDGFP, private landowners and the public are allowed to shoot prairie dogs on private lands to manage the population in prairie dog towns (SDGFP, 2005b). Therefore, NRC expects that management of prairie dogs will be conducted in accordance with applicant and land owner agreements.

The swift fox is typically found in short mixed grass prairies and preys on prairie dogs in addition to other small mammals and their carcasses, birds, insects, reptiles, fruits, and berries (FWS, 2000a). Swift fox are burrowing animals known to dig their own dens or use the burrows of other animals, including those made by prairie dogs. Because of their association with prairie dogs, swift fox that may occur in the proposed project area could be affected by prairie dog control efforts, thereby limiting available food, shelter, and escape cover for swift fox (FWS, 2000a). Other threats include the fact that swift fox are easily trapped or shot and can experience mortality from vehicle collisions (FWS, 2000a). Swift fox have demonstrated the ability to adapt to prairie-agricultural, sagebrush-grassland, and sagebrush-greasewood habitat types and to not be dependent on prairie dog colonies for their food (FWS, 2000a). For the proposed Dewey Conveyor Project, BLM concluded activities may impact individual prairie dogs and swift foxes or their habitat, but will not cause instability in their populations (BLM, 2009). NRC staff also conclude that, based on the reasons previously described in this section, the potential impacts to these species from the proposed Dewey-Burdock ISR Project construction activities will be SMALL.

The banded killifish (*Fundulus diaphanous),* a BLM sensitive species and state endangered species found in the western part of the state, and the northern redbelly dace (*Phoxinus eos*), a BLM sensitive species and state threatened species, were not observed or expected to occur in western South Dakota or Custer or Fall River Counties (SDGFP, 2012c; Table 3.6-7). As discussed in SEIS Section 3.5.1, with the exception of perennial Beaver Creek, the streams within the proposed project area generally only flow during the wet season in response to snow melt or precipitation events. Beaver Creek and Pass Creek do not provide continuous, stable aquatic habitat to support these aquatic species; therefore, NRC staff predict potential impacts to be SMALL.

Table 3.6-7 lists BLM sensitive amphibians, including frogs, and reptile species, including snakes and turtles, that could occur in the proposed project area. The snapping turtle (*Cheldy serpentine)* will be one of the most likely BLM sensitive turtle species to occur in the area (Bandas, 2004), although snapping turtles were not observed during wildlife surveys. This species can be found in any permanent water body in the state and are rarely seen out of the water except for nesting and basking in the sun (Bandas, 2004). The spiny softshell turtle

(*Apalone spinifera*) is a state rare species that prefers highly oxygenated, fast flowing rivers, lakes, and streams, but is also found in impoundments and reservoirs (Somma, 2011; Bandas, 2004). As described in SEIS Section 3.6.1.2.3, the applicant reported a spiny softshell subspecies in Beaver Creek during fish surveys downstream of the proposed project area. Turtles usually spend the winter in rivers, lakes, streams, and reservoirs with muddy or sandy bottoms and require soil exposed to sunlight, often near sand or gravel bars, during late spring or summer for a proper nest environment (Somma, 2011). Common toads and frogs were observed during wildlife surveys, but BLM sensitive amphibian species were not reported. For the same reasons explained in SEIS Section 4.6.1.1.1.1.2, NRC concludes potential impact to these sensitive reptiles and amphibians will be SMALL.

Snakes and lizards are generally less dependent than or nondependent on permanent water bodies compared to amphibians. Snakes and lizards could occur within grassland, shrubland, and sometimes woodland habitats depending on the species. The plains or western hognose snake (*Heterodon nasicus*) is a BLM sensitive species that typically burrows into sandy, gravelly, or floodplain areas, but may also occur in agricultural, shrub, and woodland habitats (WGFD, 2010). The Greater short-horned lizard (*Phrynosoma hernandesi*) is also a burrowing BLM sensitive species that prefers grassland and sagebrush habitats (BLM, 2009). Both of these species are known to be distributed within the region, but were not observed during Dewey-Burdock wildlife surveys. As described in SEIS Section 4.6.1.1.1.1.2, potential impacts to reptiles could include loss or fragmentation of habitat, displacement, disturbance from noise and human proximity, and increased risk of equipment encounters and vehicular collision. In addition, snakes can be unnecessarily killed by humans who think snakes are harmful. For example, the hognose snake resembles the rattlesnake and may invoke undue harm (WGFD, 2010), although it is not venomous and does not typically respond to enemies by biting regardless of their dramatic defense display. Construction activities are not planned during the winter months when these species will be hibernating and less responsive to ground-disturbing activities that may result in loss of life. In addition, due to the sequential development and small amount of land that will be disturbed for construction under the deep Class V injection well disposal option {approximately 98 ha [243 ac]}, staff do not expect construction impacts to measurably affect any reptile species population. Therefore, potential impacts to these sensitive reptile species during the construction phase will also be SMALL.

4.6.1.1.2 Operations Impacts

The potential impact to ecological resources during operations under the deep Class V injection well disposal option at the proposed Dewey-Burdock ISR Project will be consistent with the findings described in the GEIS summarized previously in SEIS Section 4.6. Only minor impacts to vegetative communities will occur because most of the clearing for the ISR facility will have occurred during the construction phase. Invasive and noxious weeds could potentially colonize disturbed areas, but the applicant has committed to monitor and control these. In addition, material spills and failure of settling and holding pond liners or embankment systems could also occur during the operations phase. The applicant has proposed to minimize vehicular access to specific roads and revegetate disturbed areas with an SDDENR- and BLM-approved seed mixture to prevent the establishment of competitive weeds and restore habitat to native species (Powertech, 2009a). There will be less noise and less traffic during the operations phase of the proposed project compared to the construction phase; therefore, the potential to disrupt wildlife populations will be reduced along with a decrease in the probability of vehicular collisions. Wildlife use of areas adjacent to ISR operations will be expected to increase as animals become habituated to site activities. Potential impacts to wildlife, including state and BLM species of concern, during the operations phase will continue to be SMALL because operations will not threaten the continued existence of any particular species in the proposed license area. Leak detection systems, soil monitoring, and spill response plans to remove affected soils and capture released fluids (SEIS Section 4.4.1) will minimize the impact of wildlife exposure to potentially toxic levels of chemicals.

Potential conflicts between active raptor nest sites and operations-related activities, especially the expansion of wellfield areas, will be mitigated by adherence to regulatory timing and spatial restrictions with regard to construction activities near raptor nests.

As described in SEIS Section 2.1.1.1.2.4, the applicant's deep Class V injection well disposal option will require the use of settling and holding ponds. The proposed use of settling and storage ponds presents a potential for wildlife exposure to wastewater solutions. The applicant has proposed predisposal wastewater treatment, including ion-exchange treatment and radium settling, to remove or reduce some of the regulated constituents discharged to the storage ponds (SEIS Sections 2.1.1.1.6.2 and 4.14.1). The proposed wastewater treatment approaches include monitoring the post-treatment water quality to ensure compliance with NRC, EPA, and SDDENR requirements as well as any applicable NRC license conditions (Section 4.14.1). Liquid wastes discharged to settling and holding ponds will be treated to water quality appropriate for discharge injection into permitted Class V (nonhazardous) deep disposal wells (Powertech, 2009a).

To evaluate the potential hazards to wildlife from waste management operations, the NRC staff compared the applicant's estimated concentrations of chemical constituents in the wastewater with aquatic-life and wildlife health effects thresholds. An aquatic life health effects threshold is a concentration of a chemical constituent in water that has been shown to cause health effects in aquatic life based on scientific studies. Selenium, in particular, was identified by the FWS as a constituent of concern in ISR wastewater because of low wildlife health effects thresholds in some sensitive species when compared with concentrations of selenium measured in ISR wastewater (FWS, 2007). The wildlife health effects thresholds described here establish the concentration of a chemical in water that is known to cause health effects in wildlife based on scientific studies.

For this evaluation, the NRC staff compared the applicant's estimated wastewater concentrations with EPA chronic (long-term) exposure-based water quality criteria (guidance) established for the protection of aquatic life (EPA, 2013). The staff found that the estimated concentrations of arsenic and selenium in the injectate the applicant proposes to use exceed the current EPA criteria. Additionally, the applicant's estimated concentrations of selenium exceed levels referenced by FWS (2007) as hazardous to aquatic birds. Based on this comparison, the NRC staff concludes that direct chronic exposure of sensitive species to the applicant's estimated arsenic and selenium concentrations in wastewater (undiluted) could adversely impact exposed individuals. However, NRC staff considers such chronic direct wildlife exposure to undiluted wastewater unlikely because the applicant's proposed wastewater controls (e.g., pond design, leak detection and mitigation, pressure monitoring) and SDDENR permitting requirements will limit direct contact that aquatic life and terrestrial wildlife have with wastewater solutions. The SDDENR controls include limiting access to wastewater with fencing and implementing an avian protection plan for pond operations.

Wastewater storage ponds present an opportunity for wildlife, primarily migratory birds, to have direct contact with wastewater solutions. One detailed wildlife field study of an ISR wastewater irrigation system has been published and observations made in that study identified only limited use of a wastewater storage reservoir by birds (FWS, 2000b). In the event that additional treatment to lower wastewater constituent concentrations or additional access controls for ponds are needed to protect wildlife, SDDENR has the authority to require these actions be implemented by the applicant. In the event that additional treatment to lower wastewater constituent concentrations or additional access controls for ponds are needed to protect wildlife, SDDENR has the authority to require these actions be implemented by the applicant.

Based on the previous assessment, the potential impact to ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, aquatic species, and sensitive and protected species) during the operations phase for the deep Class V injection well disposal option will be SMALL and less than that experienced during the construction phase. Therefore, NRC staff predict potential impacts to aquatic species will remain SMALL.

4.6.1.1.3 Aquifer Restoration Impacts

Impacts to ecological resources for the Class V injection well disposal option at the proposed Dewey-Burdock ISR Project during aquifer restoration will be consistent with the impact conclusions described in the GEIS, as summarized in SEIS Section 4.6, and consistent with those potential impacts described previously for the construction phase and the operations phase. Because the existing infrastructure from the operations phase will continue to be used during aquifer restoration and the applicant will continue to apply the mitigation measures described previously, the potential impact to ecological resources will be similar to that described for the operations phase. In addition, the applicant's adherence to the BMPs proposed for seasonal noise, vehicular traffic, and human proximity measures will further reduce potential impacts to ecological resources. Therefore, the potential impact to ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, aquatic species, and protected and sensitive species) during aquifer restoration will be SMALL.

4.6.1.1.4 Decommissioning Impacts

The activities resulting in impacts to ecological resources during the proposed Dewey-Burdock ISR Project decommissioning activities under the Class V injection well disposal option are consistent with the activities described in the GEIS as summarized in SEIS Section 4.6. Impacts to ecological resources during the decommissioning phase will be similar to those experienced during the construction phase with respect to noise, traffic flow, and earthmoving activities. However, the decommissioning phase will temporarily disrupt slightly more natural habitat than will have occurred during the construction phase of the ISR process; this is because of an increase in land-disturbing activities for dismantling, removing, and disposing of facilities, equipment, and excavated contaminated soils. Decommissioning and reclamation activities, as described in SEIS Section 4.2 for land use, will primarily be conducted in the previously disturbed areas of the site in accordance with the NRC-approved decommissioning plan and BLM-approved reclamation plan (BLM, 2012a). Affected areas will be revegetated using a final reclamation seed mix developed through discussions with the landowner and approved by the SDDENR and BLM (Powertech, 2009a; BLM, 2012e).

Little loss of vegetative communities beyond those disturbed during construction will be expected during decommissioning. Piping removal will have the greatest impact on vegetation that had reestablished itself since being disturbed during previous ISR phases. The dismantling of the proposed project facilities, infrastructure, and roads, and reseeding and placement/contouring of soil will have impacts similar in scale to the construction phase. SDDNER recommends that the large-scale mine permit require revegetation success be equivalent to vegetative cover in reference areas, using SDDENR-approved statistical methods. In addition, a post closure bond will be held for 30 years after the reclamation bond is released, in

order to help ensure revegetation success. However, final permit conditions may change based on the final determination by the SDDENR hearing board. The decommissioning process will be expected to create increased noise, traffic, and sediment runoff as buildings are taken down and hauled away. During this time, wildlife could either come in conflict with heavy equipment or could move elsewhere due to higher-than-normal noise. As required, the applicant will submit an NRC-approved decommissioning plan and all decommissioning activities will be carried out in accordance with 10 CFR Part 40 and other applicable federal regulatory requirements. Decommissioning of plant facilities at the proposed Dewey-Burdock ISR Project is estimated to take 2 years. Temporarily displaced wildlife could return to the area once decommissioning and reclamation were completed. The applicant's implementation of the previously discussed mitigation measures will further reduce potential impact.

At the proposed Dewey-Burdock ISR Project, the impact from dismantling and decontaminating the central plant, satellite facility, roads, and support facilities will be consistent with the conclusions reached in the GEIS. The potential impacts to ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles and amphibians, and protected species) during decommissioning for the deep Class V injection well disposal option will include disturbance of about 98 ha [243 ac] of vegetation, primarily in the upland grassland and greasewood shrubland vegetation communities. Although certain vegetative communities (shrubland) are difficult to reestablish and can take as many as 10 years to achieve full site recovery (WGFD, 2007), the applicant commits to ongoing vegetation reestablishment efforts throughout the ISR facility life cycle. New vegetative growth could be affected by future grazing, droughts, or intense winters, thus reducing the rate of plant productivity and delaying full recovery (WGFD, 2007). For these reasons, NRC staff conclude there will be a MODERATE impact on vegetation from decommissioning and reclamation under the deep Class V injection well disposal option; once vegetation has been reestablished, this impact will be SMALL.

Potential impacts to big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles and amphibians, and protected species will remain SMALL and comparable to those described for the construction phase. The removal of perimeter fencing will increase big game passage and vegetative forage. As with construction, operations, and aquifer restoration phases, potential impacts to big game during decommissioning will remain SMALL. Potential impact to aquatic species and amphibians will also remain SMALL because of the limited occurrence of surface water, and the applicant's plan to not disturb water bodies located on the proposed project site.

4.6.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant proposes to dispose of liquid waste generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). Potential environmental impacts on ecology from construction, operations, aquifer restoration, and decommissioning associated with the land application liquid waste disposal option are discussed in the following sections.

4.6.1.2.1 Construction Impacts

Planned vegetation disturbance for the land application disposal option is provided in Table 4.6-3. Approximately 566 ha [1,398 ac] of land or 13.2 percent of the proposed permit area will be potentially disturbed by activities associated with construction of facilities, pipelines, wellfields, storage ponds, irrigation areas, and access roads (Powertech, 2012a, 2010a). Disturbance to the vegetative communities will include that described in SEIS Section 4.6.1.1.1.1 for construction under the deep Class V injection well disposal option in addition to disturbance from increased pond capacity totaling approximately 55 ha [136 ac] and irrigation areas for potential land application totaling approximately 425.7 ha [1,052 ac]. The same area of BLM land will be disturbed during construction for both the deep Class V injection well and land application disposal options.

Figure 4.6-3 shows the planned facilities and vegetation communities for the land application disposal option. The additional ponds in the Dewey and Burdock areas will be located primarily in the greasewood shrubland and upland grassland vegetative communities. Ponds in the Dewey area will also be located in the silver sagebrush shrubland community just west of Dewey Road. Land application areas in the Dewey area will primarily be located in the greasewood shrubland community and a portion within the upland grassland community. The land application areas in the Burdock area will be located in the greasewood shrubland, upland grassland, big sagebrush shrubland, and silver sagebrush shrubland vegetative communities.

Table 4.6-4 provides the amount of disturbance in each vegetation community.
During the construction phase, land application piping and pivot installation will create similar impacts described in SEIS Section 4.6.1.1.1.1 including (i) modification of vegetative structure, species composition, and areal extent of cover types (density); (ii) potential invasion, establishment, and expansion of invasive or nonnative species; (iii) potential soil erosion; (iv) reduction of wildlife habitat and livestock forage; and (v) changes in visual aesthetics.
NRC staff expect the center pivot areas to consist of native vegetation or to be converted into agricultural land where alfalfa or salt-tolerant wheatgrass will be planted and grown (Powertech, 2009b); however, application of liquid waste will not begin until the operations phase. NRC expects the applicant or landowners to use earth-moving equipment to clear and till the soil in preparation for planting crops in the land application areas. The applicant will employ similar mitigative measures previously discussed for the deep Class V injection well option to minimize potential construction impacts to vegetation and habitat during construction for the land application option. NRC staff expect potential impacts to vegetation and wildlife from the increased pond capacity totaling approximately 55 ha [136 ac] will not result in measurably higher impacts to wildlife because of the small amount of additional area that will be disturbed. However, combined with the land application areas (including operating and standby center pivot areas and catchment areas) of approximately 426 ha [1,052 ac], greater impacts to wildlife are expected.
As described in SEIS Section 2.1.1.1.2.4.2, the maximum estimated area for land application is 426 ha [1,052 ac] and includes operating irrigation pivots, standby irrigation pivots, and areas constructed to contain surface stormwater runoff. As described in SEIS Section 4.6, the GEIS evaluated ISR facilities that ranged in facility size from 1,000 to 7,000 ha [2,471 to 17,297 ac] with disturbed area estimates of 49 to 753 ha [120 to 1,860 ac] (NRC, 2009a) and land application of treated wastewater. The GEIS concluded that potential impacts from operations during land application will be small, but the GEIS did not evaluate the impacts of planting crops in the irrigation areas prior to land application activities, which could have a greater impact than conducting land application on native vegetation. Because of the long-term direct impacts of approximately 566 ha [1,398 ac] of native vegetation, of which up to 308 ha [760 ac] may be converted into crops, staff conclude impacts to vegetation will be MODERATE.
BLM-managed lands within the project area are not located within proposed irrigation areas and will not experience any additional direct vegetation modification from irrigation activities under the land application disposal option. The applicant may construct fencing around land application areas to control livestock access, which could indirectly increase livestock grazing

Figure 4.6-3. Map of Dewey-Burdock Planned Facilities and Vegetation Communities for the Land Application Option
Source: Powertech, 2012a

considered a public resource and is traditionally used for livestock grazing in this region, NRC staff expect the potential indirect impacts on the vegetation of these BLM lands to be SMALL.
Staff also expect that in addition to potential impacts described earlier for the deep Class V injection well option, big game species may experience additional restricted movement due to fencing around land application areas and reduced forage and carrying capacity in the land application areas. However, because the project area is not within big game migration pathways and does not contain critical habitat and because big game species have larger home ranges and are highly mobile, the continued existence of big game species will not be threatened and impacts on big game will be SMALL.
The black-tailed prairie dog colony located within the Dewey area in land application areas could attract black-footed ferrets. The colony supports small- to medium-sized mammals that burrow in the ground, raptors and ground dwelling birds, and reptiles as described in SEIS Sections 4.6.1.1.1.1.2 and 4.6.1.1.1.1.4. Figure 4.6-4 shows the 16-ha [40-ac] areas where

raptors nests are located near the proposed project. The potential wellfield areas in SEIS Figure 2.1-6 identify where potential drilling/distruptive activity could occur around each orebody, if a particular orebody were mined. Converting land application areas into cropland during construction under this option will have a greater overall impact on such wildlife than during the construction phase under the deep Class V injection well disposal option due to the additional 481 ha [1,188] of habitat alteration and land disturbance (Table 2.1-8). The removal of sagebrush communities will most impact sagebrush obligate species, such as sage-grouse, sharp-tailed grouse, sage thrasher, and some small mammals. NRC staff expect that prey–predator relationships will be altered within the irrigation areas during construction activities and prey–predator species will leave those areas temporarily during construction activities. Raptors that nest within the proposed project area could abandon their nests. Staff expect some species to return to the area after the irrigation areas are reestablished because the cropland will provide additional nesting sites, cover, and food. Staff also expect that once the crops have been established, some raptors will also return to this area to use the cropland for active hunting.

Because NRC staff expect the applicant or landowners to disturb the surface soil to plant crops in the irrigation areas, staff also expect an increase in potential soil erosion and sedimentation could impact surface water on and downstream from the site. Land application sites are located within 0.4 km [0.25 mi] of Beaver Creek within the Dewey area; however, ISR construction activities are not expected to significantly affect surface water quality unless irrigation activities cross over into jurisdictional waters. In addition, the applicant has committed to implementing mitigation measures to control erosion, stormwater runoff, and sedimentation (SEIS Section 4.5.1.1). Because the applicant does not plan to disturb any additional water bodies and perennial streams within the proposed project area (Powertech, 2009a), NRC staff expect that aquatic species and amphibians will not be directly affected by construction of land application areas and expect impacts to be SMALL.

NRC staff expect the same mitigation measures will be followed for the land application option that were previously explained for the deep Class V injection well option. NRC staff conclude the additional amount of land that will be disturbed for construction under the land application disposal option is expected to noticeably alter, but not destabilize, the vegetation and important wildlife habitat that occur at the site. Therefore, the potential impact to ecological resources, including vegetation, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles, and some protected and sensitive species, will be MODERATE from construction of the land application option. Because no federally threatened or endangered species are expected to occur in the project area, potential impacts to threatened or endangered species will be SMALL. NRC staff expect that construction impacts will not threaten any species' population or current existence.

4.6.1.2.2 Operations Impacts

Surface disturbance, including the application of waste water, will be the primary change to ecology during the operations phase of the proposed Dewey-Burdock ISR Project under the land application option. Wellfield expansion that will disturb approximately 56.7 ha [140 ac] of land during the operations phase will have similar impacts to vegetation wildlife impacts as expected during the operations phase for the deep Class V injection well option. Disturbance of land application areas (including operating and standby center pivot areas and catchment areas) totaling approximately 426 ha [1,052 ac] will have similar impacts on vegetation and wildlife as impacts expected to vegetation and wildlife during the construction phase of the land application option.

Potential exposure of wildlife to holding/settling pond constituents and potential failure of settling and holding pond liners or embankment systems will increase under the land application waste disposal option due the additional pond capacity. In addition, the GEIS identified the following potential land application impacts from operations related to ecology: (i) reduction in growth of vegetation due to soil salination; (ii) accumulation of contaminants, dissolved solids, and radionuclides in the root zone; and (iii) increased vegetation growth due to the increase of available water (NRC, 2009a).

According to SEIS Chapter 2, the irrigation pivots will operate 24 hours a day and irrigated areas will receive approximately 1,124 Lpm [297 gpm] from March 29 to May 10, approximately 2,472 Lpm [653 gpm] from May 11 to September 24, and approximately 1,124 Lpm [297 gpm] from September 25 to October 31. From November to March, land application will not be used and treated liquid waste will be temporarily stored in ponds located near the Burdock central plant and Dewey satellite facility (Powertech, 2011). Land application activities during operations under this option will have a similar land disturbance impact on wildlife as those expected during the construction phase because of the continuous disturbance from irrigation activities. NRC staff expect that few animals will inhabit the land application areas during continuous irrigation. NRC staff also expect that prey–predator relationships will be altered within the irrigation areas because of seasonal irrigation activities and may not return during the winter season when irrigation activities are not planned. Upland game birds, raptors, waterfowl and shorebirds, nongame and migratory birds, small- and medium-sized mammals, and reptiles will experience direct, long-term habitat loss and reduction in the carrying capacity during the operations phase of the land application option. Staff expect that in general, birds are mobile and able to relocate to other available regional habitat (SEIS Section 4.6.1.1.1.4). Temporary direct impacts to animals and nests could include disturbance from sprayed irrigation water that the wind carries outside of the land application areas.

During the uranium recovery process, the groundwater extracted from the production zone is enriched in uranium and other metals that are typically associated with uranium in nature. In the license application technical report, Tables 4.2-7, 7.3-8 (Powertech, 2009b), and in their state GDP (Powertech, 2012c, Table 5.8-2) the applicant describes the expected radiological constituents and estimated concentrations in wastewater for the proposed land application activities. The radiological constituents include natural uranium, radium-226, thorium-230, and lead-210. At NRC-licensed *in-situ* leach facilities, the licensee is required to monitor and control radiological constituents in effluents to satisfy limits in 10 CFR Part 20, Appendix B, and irrigation areas to maintain levels of radioactive constituents within allowable release standards outlined in 10 CFR Part 40, Appendix A both during and after disposal by land application (NRC, 2009a). As stated in SEIS Section 2.1.1.1.6.2 for radiological emissions, the applicant proposes regular monitoring of air, soil, biomass (i.e., crops and livestock), surface water, and groundwater to identify the presence of NRC- and SDDENR-regulated constituents. The applicant's proposed land application monitoring program is described in SEIS Section 7.5. Monitoring results must be reported to NRC semiannually (see SEIS Chapter 7).

In the license application technical report (Powertech, 2009b, Tables 4.2-7 and 7.3-8) and in its South Dakota GDP (Powertech, 2012c, Table 5.8-2), the applicant described the expected chemical constituents and estimated concentrations in wastewater for the proposed land application activities. The list of chemical constituents includes arsenic, barium, cadmium, chromium, lead, and selenium. The NRC staff evaluated the toxicity of the proposed wastewater solutions and the potential for proposed land application activities to impact wildlife. Selenium, in particular, was identified by the FWS as a constituent of concern in ISR wastewater because of low wildlife health effects thresholds in some sensitive species when compared with concentrations of selenium measured in ISR wastewater (FWS, 2007). The wildlife health effects thresholds described here establish the concentration of a chemical in water that is known to cause health effects in wildlife based on scientific studies.

The NRC staff compared the applicant's estimated wastewater concentrations with EPA chronic (long-term) exposure-based water quality criteria (guidance) established for the protection of aquatic life and found the estimated concentrations of cadmium, chromium, lead, and selenium exceed the EPA criteria. The applicant's estimated concentrations of both cadmium and lead also exceed the acute (short-term) exposure-based EPA water quality aquatic life criteria (EPA, 2013a). Additionally, the applicant's estimated concentrations of selenium exceed levels referenced by FWS (2007) as hazardous to aquatic birds. Based on this comparison, the NRC estimated cadmium, lead, and selenium concentrations in wastewater could adversely impact exposed individuals.

However, the NRC staff considers such chronic direct wildlife exposure to undiluted wastewater unlikely because the applicant's proposed wastewater controls (e.g., pond design, spill and leak detection and mitigation, pressure monitoring, runoff control and mitigation) and SDDENR permitting requirements limit direct contact that aquatic life and terrestrial wildlife will have with wastewater solutions. The SDDENR controls include limiting access to wastewater with fencing, implementing an avian protection plan for pond operations, and requiring no-runoff and no-ponding conditions for land application. These controls would limit direct terrestrial wildlife exposures and migration of wastewater to aquatic life habitat areas such as nearby surface water.

Wastewater storage ponds present an additional opportunity for wildlife, primarily migratory birds, to have direct contact with wastewater solutions. The only detailed wildlife field study of an ISR wastewater irrigation system observed only limited use of a wastewater storage reservoir by birds (FWS, 2000b). In the event that additional treatment to lower wastewater constituent concentrations or additional access controls for ponds are needed to protect wildlife, SDDENR has the authority to require these actions be implemented by the applicant.

While direct wastewater exposures will be limited, as noted in the GEIS and draft SEIS, land application could lead to accumulation of trace metal constituents in soils. The NRC staff evaluated the applicant's estimated steady-state soil concentrations of trace metals from proposed land application with published EPA ecological soil screening guidance levels (Eco SSLs) (EPA, 2010). Eco-SSLs were developed to support screening analyses to identify potential ecological concerns at superfund sites that may need further, more detailed evaluation (e.g., ecological risk assessment). While Eco-SSLs were developed for superfund sites, EPA envisions that any federal, state, tribal, or private environmental assessment can use the values to screen soil contaminants (EPA, 2003). The applicant's estimated steady-state soil concentrations of trace metals (Powertech, 2009b, Table 7.3-8) exceeded EPA Eco-SSLs for cadmium, lead, and selenium. This analysis suggests the land application activities described by the applicant have the potential to accumulate specific trace metal constituents in soils at levels that could impact wildlife. Soil constituents can also be taken up in plants. They may remobilize and transport to nearby surface water and shallow groundwater; even though transport of these constituents will involve dilution. In sum, plants, groundwater, and surface water containing concentrations of trace metals provide additional routes of exposure to wildlife.

The SDDENR mine permit will establish monitoring requirements and action levels for trace metal concentrations in soils, vegetation, surface water, and groundwater that are protective of the environment. The SDDENR will review monitoring data and impose corrective actions if action levels are exceeded. Additionally, SDDENR will evaluate the environmental fate and transport of land-applied wastewater in detail (including environmental concentrations, pathways and food chains, bioaccumulation) prior to operation as part of its permitting and oversight processes. If SDDENR finds the waste management activities could impact wildlife, it will impose additional conditions on the applicant to mitigate impacts and protect the environment.

In summary, some of the chemical constituent concentrations in proposed wastewater solutions and in land application area soils estimated by applicant exceed levels known to cause impacts to wildlife. NRC staff conclude that impacts to individual animals are possible even with the practices proposed by the applicant and the SDDENR regulatory controls that will be imposed by permit conditions, which include, monitoring, setting action levels, and requiring corrective actions if those controls do not limit all direct exposures to undiluted wastewater solutions.

However, the NRC concludes the direct exposure of wildlife to wastewater solutions will be limited and that, under current regulatory controls, environmental concentrations of wastewater constituents are unlikely to reach levels that would lead to destabilization of wildlife populations.

The NRC staff conclude the overall impact on vegetation, small- to medium-sized mammals, upland game birds, raptors, waterfowl and shorebirds, nongame and migratory birds, and reptiles from operations for the land application liquid waste disposal option will be MODERATE because of the potential for some wildlife exposures to harmful constituents and the planned 8-year operation period that will alter approximately 426 ha [1,052 ac] of vegetation, wildlife distribution, and wildlife habitat. Based on the foregoing analysis, the impacts are expected to noticeably alter important attributes of the terrestrial environment; however, staff do not expect these impacts to threaten the continued existence of any species.

Because the land application option will not disturb any additional water bodies and perennial streams within the proposed project area (Powertech, 2009a), and land application treated wastewater will be controlled to avoid runoff, staff expect that aquatic habitat will not be directly affected by land application activities and potential impacts to aquatic species and amphibians will be SMALL. For the same reasons explained for construction impacts on big game from the land application option, staff expect potential operations impacts to big game from operations during the land application option to be SMALL.

4.6.1.2.3 Aquifer Restoration Impacts

During aquifer restoration, potential impacts to ecological resources for the land application liquid waste disposal option at the proposed Dewey-Burdock ISR Project will remain similar to those described previously for the operations phase. Planned activities using existing infrastructure during the aquifer restoration phase are described in SEIS Section 4.2.1.2.3. NRC staff expect land application activities to continue during the aquifer restoration phase. Because construction and drilling equipment are not used during the aquifer restoration phase, NRC staff expect impacts from human presence, noise, and wildlife mortalities from equipment to decrease compared to human presence, noise, and wildlife mortalities expected during the operations phase. The expected liquid waste flow rates for the entire project will be approximately 2,070 Lpm [547 gpm] during concurrent uranium production and aquifer restoration and approximately 1,892 Lpm [500 gpm] during aquifer restoration alone (SEIS Section 2.1.1.1.4.1.2).

As with the operations phase, impacts to potential land application areas during aquifer restoration will be mitigated by implementing a monitoring program and maintaining levels of radiological contaminants in treated waste water to allowable release limits contained in 10 CFR Part 20, Appendix B (Powertech, 2009a, 2011) and chemical constituents in compliance with state requirements and permit conditions. Considering the potential for some wildlife exposures to harmful constituents and the continued alteration of approximately 426 ha [1,052 ac] of vegetation, wildlife distribution, and wildlife habitat, the NRC staff conclude that the overall potential impacts to vegetation, small- to medium-sized mammals, raptors, upland game birds, waterfowl and shorebirds, nongame and migratory birds, and reptiles will remain MODERATE. Based on the projected magnitude of expected liquid waste flow rates during aquifer restoration relative to operations, the potential impacts to big game, aquatic species, and operations phase and will therefore be SMALL.

4.6.1.2.4 Decommissioning Impacts

Staff expect the potential ecological impacts of decommissioning for the land application liquid waste disposal option will be similar to those described in SEIS Section 4.6.1.1.4 for the deep Class V injection well disposal option, including increased human presence, noise, and construction and field equipment. In addition to those activities planned for decommissioning under the deep Class V injection well disposal option, irrigation area pipelines, access roads, and larger pond areas will be directly impacted under the land application disposal option as explained in SEIS Section 4.6.1.2.1.

The dismantling of the proposed project facilities, piping, infrastructure, and roads and reseeding and recontouring will have fewer ecological impacts than those experienced during the construction phase due to continuous revegetation efforts during the ISR lifecycle. SDDNER recommends that the large-scale mine permit require (i) the collection of baseline vegetation data within land application areas; (ii) concurrent and interim reclamation in all areas where mining or land disturbance is completed; (iii) that revegetation success be equivalent to vegetative cover in reference areas using SDDENR-approved statistical methods; and (iv) that a post closure bond be held for 30 years after the reclamation bond is released to help ensure revegetation success. However, final permit conditions may change based on the final determination by the South Dakota hearing board. Noise, vehicle and equipment use, and human presence will increase to levels similar to those experienced during the construction phase and for the same expected amount of time (2 years). For these reasons, NRC staff conclude there will be a MODERATE impact on vegetation, small- to medium-sized mammals, raptors, upland game birds, waterfowl and shorebirds, nongame and migratory birds, and reptiles from decommissioning and reclamation under the land application liquid waste disposal option until vegetation has been reestablished and preconstruction wildlife populations return to the area. For the same reasons explained in SEIS Section 4.6.1.1.4, potential impact to big game, aquatic species, and amphibians will remain SMALL from decommissioning under the land application option for the proposed project.

4.6.1.3 Disposal Via Combination of Class V Injection and Land Application

For the combined deep Class V injection well disposal and land application option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the Class V injection well disposal capacity (Powertech, 2011). For the reasons explained in SEIS Section 4.2.1.3 for operations impacts to land use under the land application option, the significance of impacts that could impact either vegetation or wildlife populations for the combined disposal option will be less than for the land application option but greater than for the deep Class V injection well disposal option, as reflected in Table 4.6-5. Therefore, NRC staff conclude that the ecological impacts of the combined deep Class V injection well and land application disposal option for each phase of the proposed Dewey-Burdock ISR Project will bound the significance of ecological impacts of the deep Class V injection well option and the land application option.
staff concludes that direct chronic and acute exposure of sensitive species to the applicant's